



FROM KAZAN (WITH LOVE?) — RUSSIAN HELICOPTERS TAKE AIM AT AFRICA

WIN FORD FOCUS
WORTH OVER
R230 000



TECH » SCIENCE » WHEELS » HOME » OUTSIDE

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Popular Mechanics



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AMERICA'S
OIL REVOLUTION
IN PURSUIT OF ENERGY
INDEPENDENCE

GUTS, GLORY and MEGAPIXELS
HOW A SURFER REVOLUTIONISED DIY VIDEO



Redeeming the OSPREY

FIXING THE WORLD'S MOST COMPLICATED PLANE



HOW TO

- Make a bike-pump bottle rocket
- Build the ultimate computer desk
- 20 ways to open a beer (seriously)
- Cooking with smoke: you can do it
- Construct your own BMX circuit



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The All-New GS



FEATURES

- 26 **Fixing the Osprey**
The world's most complicated plane sheds its bad reputation with battlefield success
- 39 **Surfboard... a brief history**
Where it began, and where it's heading
- 46 **The Russians are coming**
Embracing *glasnost*, playing with helicopters
- 54 **The big play**
Could the US ever declare energy independence? PM digs deep
- 70 **Survival skills 101**
Count them: 20 ways to open a beer

TECH

- 64 **DIY tech**
Build the ultimate computer desk
- 72 **Digital clinic Q&A**
 - Interpreting streams
 - Update overload
 - Don't be an idiot
- 92 **Capturing the moment**
Know your lenses, shoot yourself

SCIENCE

- 12 **Tech watch**
 - Into the ocean depths
 - Death of a drone
 - Visitor's guide to the Milky Way

WHEELS

- 78 **New on the block**
 - BMW hybrid mixes it up
 - Toyota Etios: Tazz reinvented
 - VW refreshes CC flagship
 - Geneva's eco-glamour
- 94 **Saturday mechanic**
20/20 vision: upgrade to a reversing camera
- 96 **Car clinic Q&A**
Party lights

OUTSIDE

- 20 **Guts, glory and megapixels**
How a surfer-turned CEO revolutionised DIY video
- 32 **Build a bottle rocket**
Go on, turn your afternoon into a blast
- 87 **DIY adventure**
Build your own BMX track

IN FOCUS

- 66 **Mobile computing**
 - Hardcore gaming to go
 - Portable performer
 - Bend me, shape me

UPGRADE

- 50 **Ideas that could change your world**
 - Taking wing with *Synergy*
 - Weird name, cool bike
 - Lethal weapon, times two
 - Play the game

HOME

- 85 **DIY weekend**
Power ballad
- 88 **Cooking with smoke**
Take a steel drum, throw in a few plumbing parts, add meat

PM DIGITAL

- 84
 - Jetman Yves Rossy flies over Rio: see video
 - PM's reader trip to Matjiesfontein and SALT
 - WIN: Docking systems, cool Tivoli radios

MONTHLY

- 4 Contact us
- 6 Editor's notes
- 8 Letters
- 10 Time machine
- 40 Great stuff
- 112 Do it your way

futur@tech2012

Reserve your seat now for PM's FutureTech conference in Johannesburg on 25 October. For details, see page 86.

ALSO... Submit your entry soon and stand a chance of becoming South Africa's **Inventor of the Year** (big cash prizes are up for grabs in two categories). For details, see page 24.

On the cover: An MV-22 Osprey, proprotors loaded for stowage, at US Marine Corps Air Station Miramar. **Picture:** Jastin Fantl
This page: Pumpjacks pull crude oil from the Bakken Formation near Tioga, North Dakota. **Picture:** Benjamin Lowy



46



50



12



88



64



20



WIN

A desirable
Ford Focus worth
over R230 000
(see page 73)



32



WIN

WIN One of 4
GoPro HD Hero2
waterproof
action cameras
worth R3 699
each (see page 4
for entry details).



54

WIN

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1. Entry is open to anyone except employees (and their immediate families) of Ramsay Media, Omnico and associated agencies.
2. Only one online entry per person. You may enter via SMS as many times as you like (SMS charged at R1,50).
3. Competition runs until 31 July 2012.
4. We will draw the winner(s) on 10 August 2012.
5. The prize is not redeemable for cash.
6. The judges' decision is final and no correspondence will be entered into.
7. Regrettably, only South African residents are eligible for prizes.
8. Prizes not claimed within 3 months will be forfeited.

Popular Mechanics

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FOR OUR CURRENT SUBSCRIPTION RATES, SEE PAGE 73

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EXPLORING THE FINAL FRONTIER

Two space-related developments deserve special mention this month, both of which will resonate with PM's audience. Up first is the magnificent achievement by former South African Elon Musk and his SpaceX team, who made history by building and launching the first privately built spacecraft to rendezvous with the International Space Station.

Their Dragon capsule delivered supplies and equipment to the International Space Station and returned safely to Earth on 31 May, landing in the Pacific. As Nasa points out, the mission's true impact will be seen in the coming months as the company sends regular re-supply missions to the orbiting outpost. If all goes according to plan, SpaceX

will launch astronauts into orbit in a few years' time. Said an elated Musk, the founder, CEO and chief designer for California-based Space Exploration Technologies (SpaceX): "This was a crucial step, and makes the chances of becoming a multi-planet species more likely."

Then there was the long-awaited announcement from the SKA Organisation, revealing that the world's largest radio telescope project – the Square Kilometre Array (SKA) – would be split between Africa and Australia, with a major share of the telescope coming to this country. Although the decision was something of a compromise, it remains excellent news for the science community and the country as a whole. Why should this make you excited? Because the SKA is expected to answer some of the most fundamental questions in physics, astronomy and cosmology. If you'd like to know more, you are strongly urged to explore the SKA's science objectives at www.skatelescope.org/the-science.

Finally, we report back on a PM reader trip that took us to the quaint Karoo village of Matjiesfontein and the SALT (Southern African Large Telescope) facility outside Sutherland; see the pictures on this page. We enjoyed it so much (the Laird's Arms sing-along at Matjiesfontein was memorable for a number of reasons), and the feedback from our readers was so good, that we have every intention of following up with more tours that focus on the interests of our information-hungry – and undoubtedly fun-loving – audience.

Alan Duggan

aland@ramsaymedia.co.za

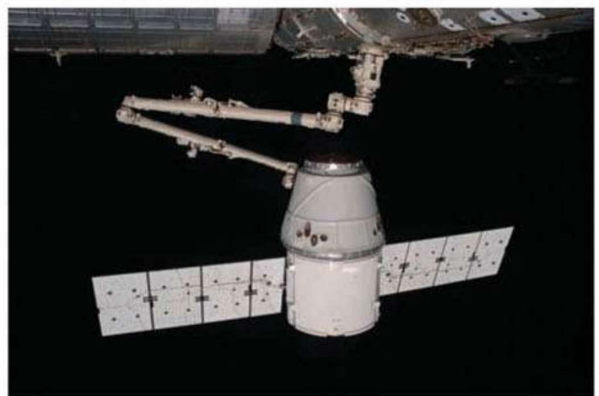
● Credit where due

The picture of climbers on Shelter Rock, featured in our article titled "Climbing the iron way" (May issue, page 73), was taken by Erwin Niemand.

SpaceX



SpaceX's Falcon 9 engines ignite during the rocket's launch at Cape Canaveral.



View of the SpaceX Dragon spacecraft as the International Space Station's robotic arm moves it into place for attachment.



The Dragon spacecraft floats in the Pacific, awaiting recovery ships.

PM READER TRIP TO SALT



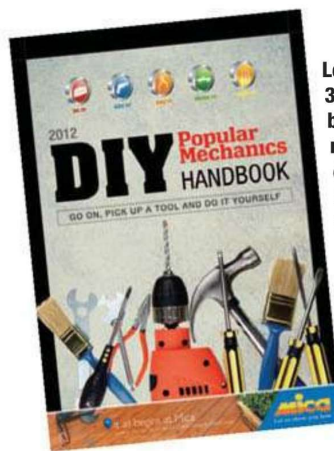
Our guests file into Matjiesfontein's historic Lord Milner Hotel. Soon afterwards, they were taken on the world's shortest bus tour.



The versatile and irrepressible "Johnnie" leads a sing-along around the piano in the Laird's Arms pub. He also hosted our bus tour of Matjiesfontein.



Keith and Margie Cowling of Faircape Travel, who (together with John Batchlor) helped us put the SALT tour together.



Look out for the free 32-page DIY Booklet bagged with this month's issue. (Your next step is to pick up a tool and actually do something useful.)

COMPETITION WINNERS... Details online at www.popularmechanics.co.za

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Winning
letter

FACEBOOK: PROCEED WITH CAUTION?

Richie Freeman's article on social media no-nos (June issue) delivered a salutary reminder of the easy and occasionally reckless way in which we communicate via Facebook, Twitter and other channels. Call me old-fashioned, but I find it deeply offensive when someone comments on a tragic event – people even do it for bereavements! – in the awful, truncated style of Twitter. The very name seems so trivial.

I told someone (at home, in England) a few days ago that this form of communication should be restricted to people who feed on celebrity, have a vocabulary of around 10 words, and brain cells to match. But then I came across a very good Twitter feed by no less than Stephen Fry, who fits none of these categories, and my son showed me half a dozen other Tweeters whose superior intellects are beyond question. Convince me, someone!

MARTIN DE JONGH
VISITOR FROM UK



Write to us, engage us in debate, and you could win a cool prize; this month's best letter wins a Casio G-Shock GA-100 watch worth R1 499. This ruggedly attractive, shock-resistant timepiece features a 1/10 000th-second stop watch, velocity indicator, world time, an auto LED light, and water resistance to 200 metres. For more information, contact 011 314-8888 or visit www.jamesralph.com



Send your letter to: Popular Mechanics, PO Box 180, Howard Place 7450 or e-mail popularmechanics@ramsaymedia.co.za Please keep it short and to the point. Regrettably, prizes can be awarded only to South African residents.

Nice... but a word of caution

I really liked the perpetual water tap feature – in fact, I am building a miniature version to sit atop my tropical fish aquarium, to be fed from the high-flow filter pump and draining back into the tank through a pot with artificial plants. The tinkle of water in the late evening should be very restful.

However, a word of warning to anyone building the feature for their garden, as per your article: be very careful with the routing of the conduit pipe carrying the electrical power cable to the pump. As it is shown in the sketch, there is a very real danger that water may siphon out of the bucket and flow along the conduit. This is almost guaranteed if the water level rises above the loop in the conduit, which could

easily happen as a result of heavy rainfall or an over-enthusiastic garden sprinkler, or when refilling the bucket from a hose to replace water lost through evaporation or splashing.

Of course, the conduit has to be brought above ground at some point, but one needs to ensure that there is no danger of water travelling along the pipe to the vicinity of the fountain switch. In any case, it's not a good idea to have stale water sitting permanently in the conduit. My advice: make this an intrinsic part of the fountain design. Either raise the loop in the conduit so that it is well above any potential water level, or introduce a small vent hole and tube.

BERNARD DUCHEN
HIGHLANDS NORTH



Of taps and knots

Your article on the "perpetual water tap" (May issue) refers. There is another way of doing this whereby the tap appears to have no water supply at all. It's done by supporting the tap on a see-through plastic pipe; the observer is unable to see the water flowing through the pipe. Regarding a letter ("Know your knots") in the same issue of PM: your correspondent should try to acquire a copy of *The Ashley Book of Knots* by Clifford W Ashley; it's the "Bible" of knotting, featuring over 3 800 types.

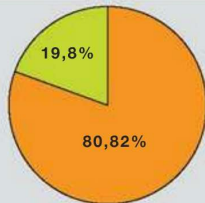
MALCOLM BARNFIELD
VIA E-MAIL

MONTHLY POLL

There are plans to mine Near-Earth Asteroids (NEAs) for raw materials ranging from water to precious metals. Do you agree with this venture?

☒ Yes. Tapping into this rich resource will help sustain Earth's ever-growing population, and water from "out there" could revolutionise space travel. 80,82%

☐ No. This would negatively impact the solar system during mining operations, and for years afterwards. It's also incredibly dangerous. 19,18%



Conducted online at www.popularmechanics.co.za – visit PM's Web site to vote in our current poll.



Needed: a sensible perspective

Your latest magazine kept me reading until well after midnight, which says a lot for your choice of material, and I had to laugh when I saw the quote at the bottom of the article featuring garments that become transparent "in response to your beating heart". In my mind, the John McClane character (from the *Die Hard* movies) has become so intertwined with actor Bruce Willis that I can easily picture the man in his (Hollywood?) home, slipping a frozen pizza into the oven with an expression that radiates a job well done.

However, the real gem in your June issue is an article with the headline, "I just can't quit you, technology". I've been banging a similar drum for years – not because I'm any kind of Luddite, but because I believe we need to view modern technology, and especially the subset dealing with communications, from the proper perspective. You make the following statement in the introduction to your Tech Focus supplement: "Fact: technology rules our lives, and that's a good thing." My response: are you absolutely sure about that? Evidence suggests that some technologies are no longer a means to an end, but an end in themselves. In that case, what's the point?

MONICA HILL
CAPE TOWN

Last word on loadbed extensions

Your May issue ("Letters") carries some negative criticism of my bakkie loadbed extension project. I should point out that in my original e-mail, I emphasised that



All at sea?

Fabulous issue – one of the best ever – and packed with the usual feast of technology that has made PM my favourite read for the past six years. Your analysis of the *Costa Concordia* disaster ("What went wrong", June issue) was particularly interesting, if slightly alarming. Until I read this article, I had been toying with the idea of taking my wife on a Mediterranean cruise to celebrate a special birthday; now I'm not so sure. If human error (stupidity?) can so easily make rubbish of the protection afforded by sophisticated safety systems, not to mention the accumulated know-ledge and common sense of generations of mariners, why should anyone feel safe on the high seas?

R BARNES
EAST LONDON

the extension was intended to prevent tools and loose equipment from falling off, and was not suitable for loading heavy equipment. The idea was to create more space, not to accommodate more weight.

TRAVIS J CARLSON
VIA E-MAIL

Editor's note: Quite right. We apologise for the omission.

Teetering on the edge

Thank you for introducing "On the edge" (May issue) to your readers. What an incredible array of 192 viewpoints, presenting so many brilliant and innovative ideas. Albert Einstein said: "The most beautiful experience we can have is the mysterious. It is the fundamental emotion which stands at the cradle of true art and true science." Hopefully there will always be a little mystery left for our great grandchildren. I think there will be.

KIT DU PLESSIS
SOMERSET WEST

Editor's note: We had enough space for just two of these thought-provoking essays. To read the others, visit edge.org

C'mon people... let's play

I have spent quite a bit of time on the Internet, following several links on the lines of "converting normal motor vehicles to electric". It seems electrically powered

vehicles such as forklifts make great donor vehicles. There are several interest groups in America with lots of success stories covering everything from dragsters and motorcycles to runabouts used on a daily basis.

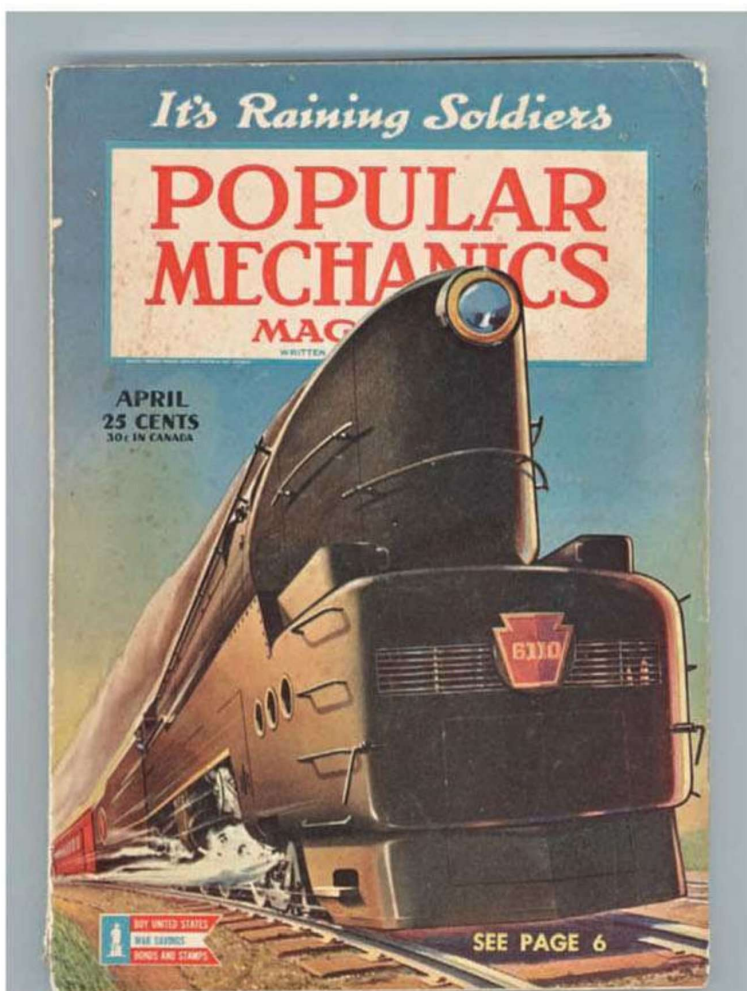
I also came across "hybrid" conversions that employ an electric motor connected to the driveshaft, or alternatively, have electric motors driving the rear axles, with conventional power at the front wheels (that is, hybrids). Would it be possible to do an article on this topic, and rope in like-minded people? Let's play together!

MANIE NEL
VIA E-MAIL

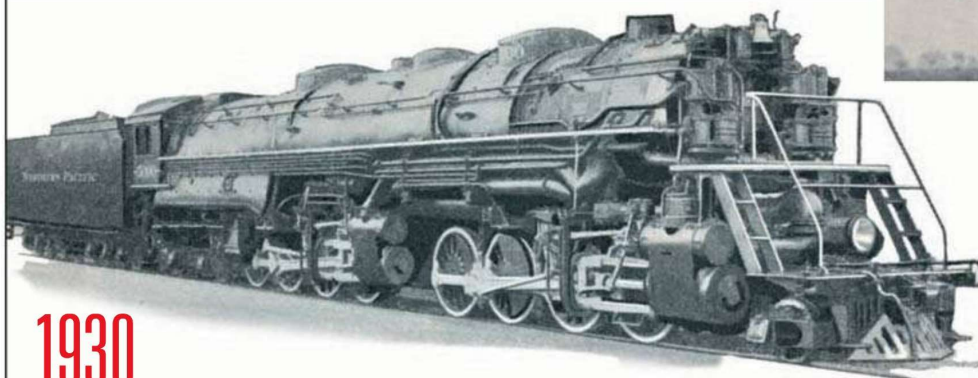
Cast out the beam

PM's monthly "Great stuff" pages always dish up interesting gadgets, ranging from the desirable to the outright weird, and I have bought quite a few over the years. Occasionally, however, I have to question the usefulness of an item – for example, the laser guidance system for chainsaw operators that projects a beam on to the ground to help you determine in which direction a tree will fall (June issue). Personally, I'd be inclined to judge by the angle of the cut, the slant of the trunk – if any – and other, "non-techie" factors such as wind speed and direction.

MIKE SULLIVAN
ILLOVO PM



1943 Our cover illustration showcased one of two streamlined steam locomotives that hauled 880-ton passenger trains on the Pennsylvania railway between Harrisburg and Chicago. Built to make the 1 147 km run with only one refuelling stop, these impressive beasts had a top speed of 160 km/h. The vast tender carried 37 tons of coal and 73 800 litres of water.



1930

Another locomotive, this one touted as one of the world's biggest. It was capable of hauling 3 600 tons of cargo up a 1 per cent gradient, burning coal at the rate of 20 tons an hour. Interestingly, our article was not about the locomotive's impressive specs, but instead focused on whether it should be referred to as "he" or "she".



1943

Back in the day, before we knew that smoking was dangerous and antisocial, we carried this advertisement for a well-known brand of pipe and cigarette tobacco. Aside from the claim that pipe smokers made women smile at home, at the office and out on dates, the advertiser produced the bombshell revelation that it didn't matter whether the women were blonde or brunette!



1954 All of 58 years ago, the US Navy's rocket-powered Kellett KH-15 rotorcraft was being used for studying gyrostabilising controls for helicopters. Apparently it wasn't especially comfortable in wet conditions.

PM

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EXPLORATION

To the abyss

On March 25, James Cameron became the third person – and the only one travelling solo – to visit Challenger Deep, 10,9 km below the western Pacific Ocean's surface. With the help of the Australia-based Acheron Project, the director engineered the *Deepsea Challenger*, a one-of-a-kind vertical-descent submersible equipped with HD 3D cameras [1], tools to gather scientific samples [2], and specially designed batteries housed in plastic cases filled with silicon oil [3].

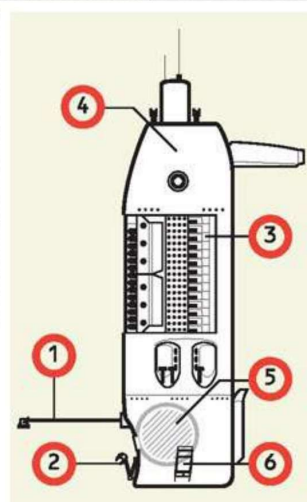
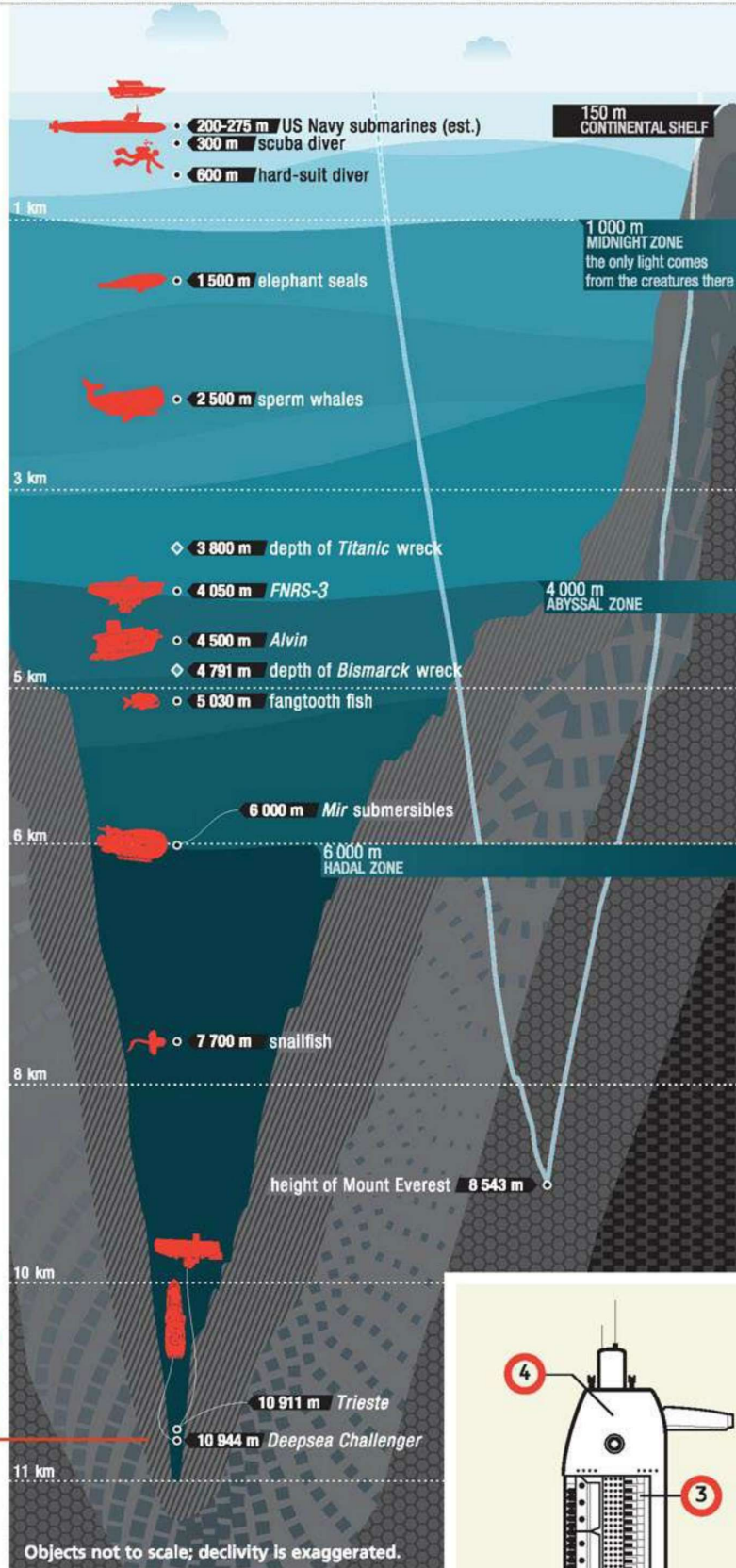
Instead of building the sub out of steel and using foam to make it neutrally buoyant, Acheron created a new syntactic foam – epoxy resin containing hollow glass microspheres – that serves as the main structural material [4]. Cameron sat in a 6,3 cm-thick, 109 cm-diameter steel sphere [5], where he controlled the sub with joysticks. *Deepsea Challenger* reached the bottom in 2,5 hours with the help of 450-plus kilograms of steel weights [6].

Cameron had to resurface after three hours on the sea floor because of a hydraulic leak – he flipped a switch to jettison the weights and ascended in 70 minutes – but by and large, the sub performed as planned. “Yeah, your life is at risk any time you go into a hostile environment like that,” he told *POPULAR MECHANICS* last year. “But you trust the engineering.” – Erin McCarthy

James Cameron's sub was only the second craft to reach Challenger Deep in the Mariana Trench. Here, we show the maximum diving depths of sea creatures and other objects of underwater exploration.

World's deepest tweet @JimCameron

▼ “Just arrived at the ocean's deepest pt. Hitting bottom never felt so good. Can't wait to share what I'm seeing w/you.”

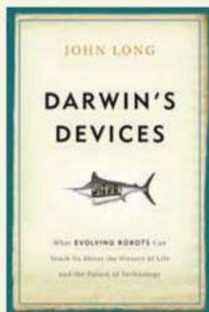


Photograph by National Geographic (James Cameron); Illustrations by Lana Bregina (Mariana Trench), Dogo (sub inset)

> Visit www.popularmechanics.co.za to watch James Cameron reach the deepest point of the Mariana Trench and break a world record for the deepest solo dive.

60-second genius

What can robots teach us about evolution?



John Long, author, biologist and cognitive scientist:

“In our lab, we conducted predator-prey experiments with evolving robots engineered to resemble fossil fish. These fish-like robots competed to feed better and flee predators faster. We used computer models to keep track of genetic changes. From generation to generation, we found that the robots became faster. We were evolving the tail, vertebrae and lateral line, but not the brain. People assume that human capability owes mostly to our big brains, but much of what we think of as human intelligence derives from the way the body is constructed. We also learned from the robots that evolution does not always make for better design. The number of vertebrae increased until reaching an optimal equilibrium, but tail size and shape fluctuated. Ultimately, the winning traits were passed on, which, of course, describes evolution.” – AS TOLD TO ALISON BROWER

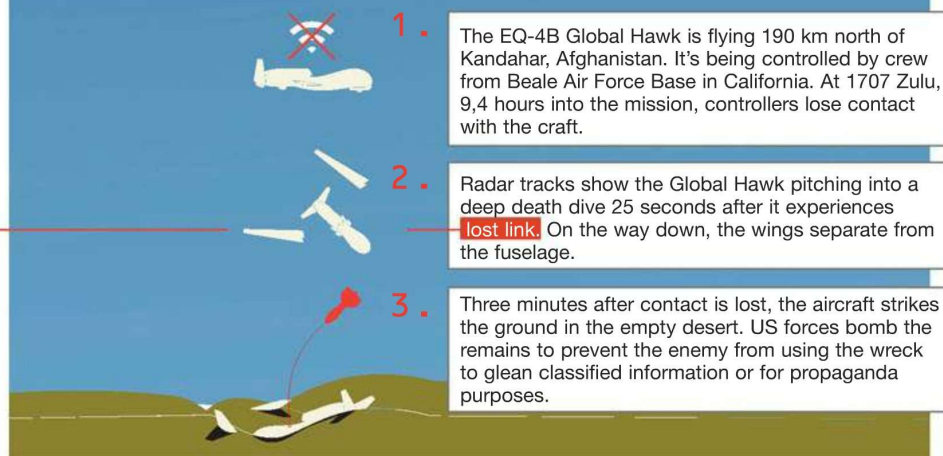
WHAT WENT WRONG



Death of a drone

HOW A LOOSE SCREW DOWNED A R580 MILLION AIRCRAFT

The US Air Force recently released the results of an investigation into the crash of a Global Hawk unmanned aerial vehicle that had been flying over Afghanistan. As in many aviation accidents, a small oversight led to a catastrophic failure. No one was injured, but the military lost one of the few Global Hawks configured as a beyond-line-of-sight communication relay. – BY JOE PAPPALARDO



PROBABLE CAUSE

The EQ-4B's mission-management computer was unable to govern flight-control surfaces called ailerons. Insufficient capscrew torque (that is, a loose screw) appears to have allowed a wire to work free, sapping power from the onboard computer and causing the aircraft to tumble from the sky.

GLOSSARY

Lost link: When operators of an unmanned aircraft lose command and control. Military UAVs are pre-programmed to fly a contingency route to a rally point when this occurs; the malfunction that doomed the EQ-4B prevented it from completing this emergency command.



○ DON'T ASK GLENN

LED astray

WHERE HAS ALL THE DARKNESS GONE?

WHEN I WAS A CHILD, in the 1970s, my parents plugged in a 4-watt night light near my bedroom door to keep me from crashing into walls on my way to the bathroom. My two young sons don't need such a thing. Their rooms are lit by the soft glow of LEDs, seeping out of various appliances, toys and electronic devices. Together, they produce what I call the underglow. It has infiltrated every corner of my home, which I can navigate at night by LED beacons alone.

LED indicators are suffering from gratuitous overuse. Commercial light-emitting diodes were first used in Hewlett-Packard calculators in the 1960s, and in the 1970s, Fairchild Optoelectronics introduced a planar process that reduced the cost to a few cents apiece. Today, the lights are everywhere, silently communicating: "Your phone is charging." "Your hard drive is working." "Your baby monitor is monitoring."

Alan Hedge, a professor of ergonomics at Cornell University's Department of Design and Environmental Analysis, says the lights should convey three types of "need to

know" information: power (the device is on), warning (something's wrong), or confirmation of action (something's changed). All else is decorative or extraneous. "Good ergonomic design means you provide the appropriate amount of information," he says.

In most cases, an indicator light simply lets you know the device is on. But most modern electronics are in a constant state of standby, so the LED glows whether or not a device is in use. Some gadgets blink while standing by; in sleep mode, Apple's MacBook Pro pulses its light like a synesthetic snorer.

The LED indicator proliferation is due partly to the litigious nature of consumer culture. (Hedge cites manufacturers' fears of "failure to warn" lawsuits.) But most LEDs are added because product designers see no reason not to. "Often in the world of design, if you can afford to do something, you do it," Hedge says. But even if a functional case could be made for each of these lights individually, in aggregate they just create sensory pollution and dilute the message each light ought to deliver: "Hey, something's going on with this device."

I'm a lover of electronics – but also a canary in this particular coal mine. If the glowing lights in my house indicate a trend, then I'd like to start the backlash now. Enough with the LEDs already. If there's no critical reason for a device to emit light, then it shouldn't emit light. We consumers are not afraid of the dark. – **BY GLENN DERENE**

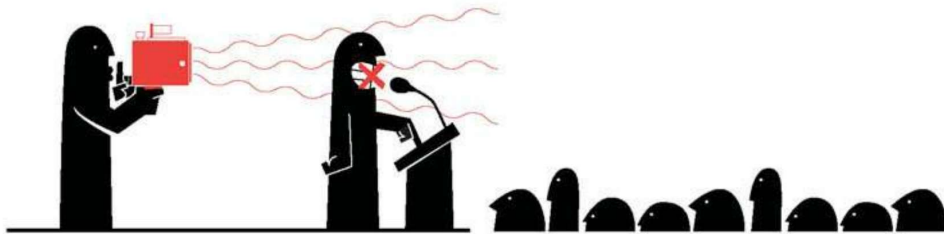


Illustration by Calum Alexander Watt



QUICK HITS

OF ACCELERATORS AND ART INVESTIGATIONS The Louvre in Paris holds many of the world's most famous works of art – but most people never see the particle accelerator in its basement. Scientists use the machine to analyse the composition and origins of artwork. For example, the accelerator helped determine that the ruby eyes in a Babylonian statue of Ishtar came from a mine in Vietnam, indicating that the two regions established trade routes at least 4 000 years ago. Such high-tech forensics are employed elsewhere in the art world, too: an accelerator helped crack a R288 million art forgery scandal in 2011, when its proton-induced X-ray emissions provided damning evidence about paint pigments used in the forgeries. – **ALEX HUTCHINSON**



DEVICES IN DEVELOPMENT

Voice over

RESEARCHERS CREATE A DEVICE THAT CAN PUT A PERSON ON MUTE.

UNTIL NOW, THE ONLY GUNS that could stop a person from talking fired bullets (okay, we'll discount stun guns). Now, Japanese researchers have created a non-lethal version. The SpeechJammer uses delayed audio feedback to reduce its target to a stammering mess. It does so by interfering with one's ability to process what has been said, explains Shanqing Cai, a postdoctoral associate at Boston University's Speech Lab (who was not involved in creating the device).

"When you're producing speech, the brain tends to monitor the auditory feedback," he says. "The previous words in a sentence are used as triggers for the ensuing words." The SpeechJammer's directional microphone records the target's speech and re-broadcasts it on a speaker with a 0,1- to 0,3-second delay aimed at him or her. "The brain is essentially fooled into thinking the sounds or syllables it intended to produce have not been produced correctly," Cai says.

That glitch causes the target to involuntarily stutter while the brain searches for the "correct" speech. Although the applications for this technology may seem Orwellian – a way to silence protestors – Cai predicts that the gun won't be effective against crowds. The goal is to help facilitate discussion, not end it, says Kazutaka Kurihara of the National Institute of Advanced Industrial Science and Technology, one of the inventors. – **BY STEVE ROUSSEAU**

NATURE'S ARMS RACE

Fish face-off

ARAPAIMA

Scientific name: *Arapaima gigas*

Length: 2 to 2,4 m

Habitat: Amazon River basin

Outer scales: Up to 10 cm long

Hardness of outer layer: 500 megapascals

Hardness of inner layer: 200 megapascals

RED-BELLIED PIRANHA

Scientific name:

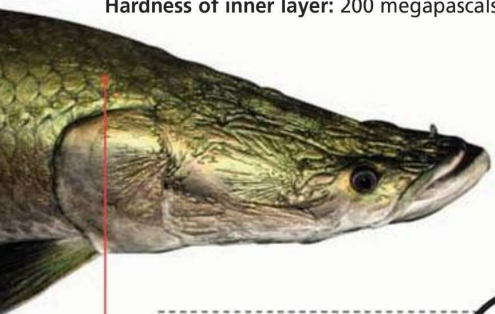
Pygocentrus nattereri

Length: 76 mm to 230 mm

Habitat: South American rivers

Bite force: 32 kg (30 times its body weight)

VS



Corrugated scales allow the fish to flex as it moves.

Arapaima scales have internal layers of collagen fibres stacked in alternating directions to one another for maximum toughness.

THE BRAZILIAN

ARAPAIMA makes a large, tempting meal for the schools of piranha that share its river habitat. Good thing, then, that this prey's scales are impervious to piranha teeth; the scales have a hard, mineralised layer that covers tough muscle. Engineers at UC San Diego attached piranha teeth to a hole punch machine to simulate attacks. The teeth penetrated the scales part-way, then broke. The researchers suggest that similar designs could produce stronger body armour, better insulation and advances in aerospace technology. – **ALEX HUTCHINSON**

QUICK HITS

Light from pure crystal

The inventors are calling it "LED 2.0" – a 12-watt bulb that produces 10 times more light than conventional LEDs. Rather than having a sapphire or silicon substrate like its competitors, the new bulb is made of pure gallium nitride crystal. That makes it more expensive, but Californian start-up Soraa says the bulb pays for itself in energy savings in less than a year.

BRAIN HACKING FOR ROOKIES

Forget chemistry sets – the next generation of amateur scientists will be plumbing the mysteries of the brain. The SpikerBox kit (about R800 from Amazon), developed by neuroscientists Greg Gage and Tim Marzullo, allows users to amplify and listen to neurons firing in invertebrates such as crickets and cockroaches. When connected to a smartphone, the kit can record and graph how the nerve signals respond to touch, temperature and other senses. Backyard Brains, the company behind the SpikerBox, has also introduced Robo-Roach (R800), which allows home users to surgically modify a cockroach to turn left or right in response to electrical pulses.

VIDEO > Visit www.popularmechanics.co.za for details on where to buy your own SpikerBox and RoboRoach, as well as for instructions on how to assemble each of the kits. Look out for the quirky SpikerBox commercial, too. (Search keywords: Backyard Brains.)

Visitor's Guide to... THE MILKY WAY

YOU ARE
HERE

Astronomers recently determined the exact colour of the Milky Way:
"A very pure white, almost mirroring a fresh spring snowfall."

SCIENTISTS ANNOUNCED in January that 10 billion stars in the Milky Way may be orbited by Earth-like planets. Not only are these planets expected to be similar in size to our own, but they're also located in zones temperate enough for liquid water to form. That's good news for intergalactic tourism, says University of Copenhagen astrophysicist Uffe Jørgensen, who led the research. Jørgensen predicts that people will begin colonising the Moon and Mars, then eventually travel to planets around other stars. Here's what adventurous planet-hoppers should know before leaving home. – BY SARAH FECHT

Natural wonder



Nothing beats a double sunset. The planets Kepler-16b, -34b and -35b each orbit two stars at once, much like Tatooine in *Star Wars*. According to new research, such double-sun planets may be common throughout the galaxy.

Luxury shopping



Orbiting a pulsar in the Milky Way's Serpens, or Snake, constellation, may be the most beautiful planet you'll ever lay eyes on. It is certainly the most valuable. This rock is about five times the diameter of Earth and made almost entirely of diamond.

Clubs and nightlife



Astronomers have found a mysterious haze at the heart of the galaxy. The light appears to be produced by an "absolutely enormous" cloud of energetic particles racing through the galaxy's magnetic field, but the particles' origin has so far defied explanation.

Outdoor recreation



A small black hole named IGR J17091 produces some of the fastest winds in the galaxy – perfect for hardcore paragliding. The magnetic fields around the black hole cause material to rush away from it at about 32 million km/h.

BE SURE NOT TO MISS!



HOME EXCHANGE

Located 620 light-years away in the Cygnus constellation, Kepler-22b is just 2.4 times Earth's size. It orbits a Sun-like star and may even have Earth-like temperatures.



FIREWORKS

Celebrate the birth of new stars at Cygnus X, one of the most active regions of star formation in the galaxy. Shock waves, intense UV light and stellar winds create a spectacular show.



SPA TREATMENT

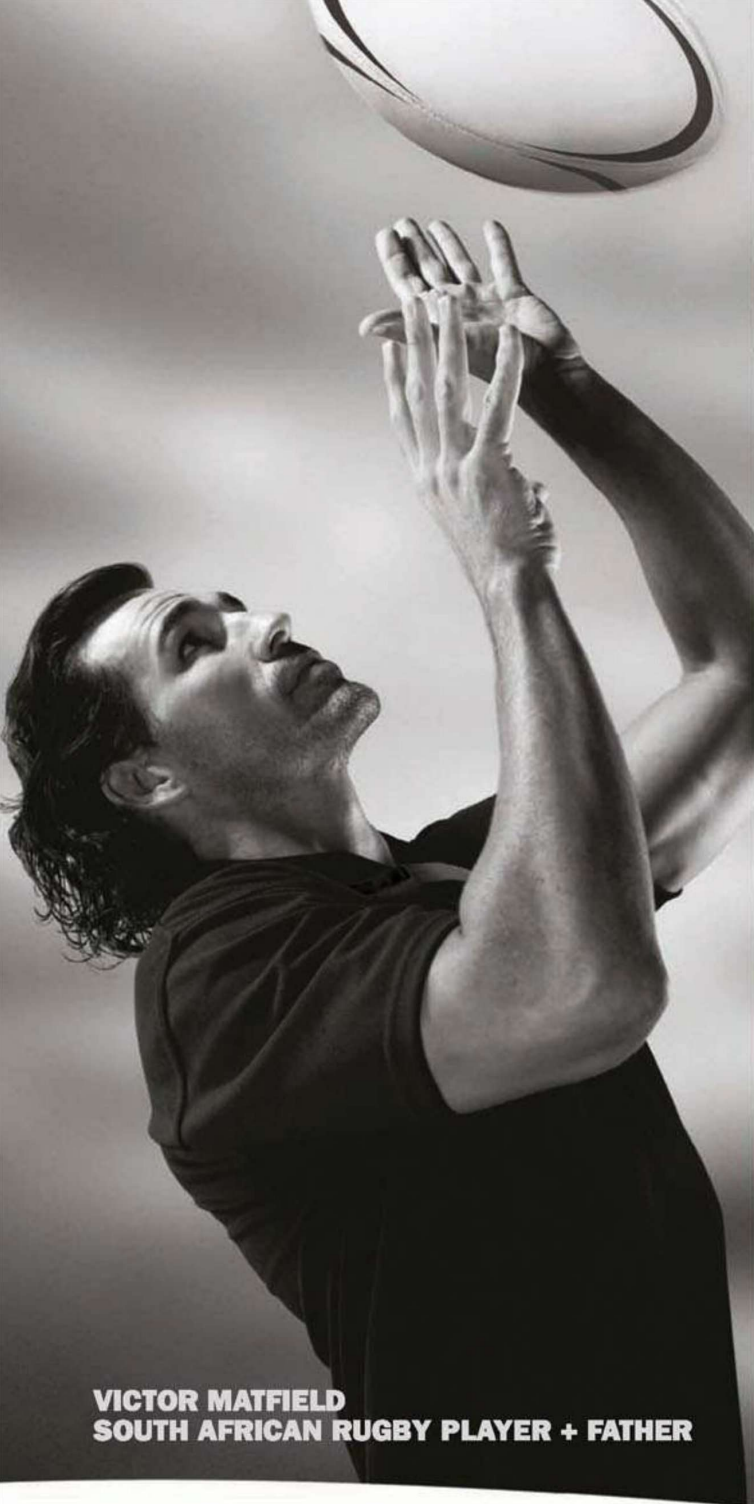
At upwards of 232 degrees Celsius, the watery planet GJ1214b has a steamy atmosphere. Deep inside it, H₂O behaves strangely, creating materials such as hot ice and superfluid water.



HISTORIC LANDMARK

Two gamma-ray bubbles, each 25 000 light-years tall, straddle the galactic centre. They're probably the product of star formation or the eruption of a supermassive black hole.





VICTOR MATFIELD
SOUTH AFRICAN RUGBY PLAYER + FATHER



TOUGH OR CARING. WHY CHOOSE?

[48H. TOUGH ON SWEAT, NOT ON SKIN.]

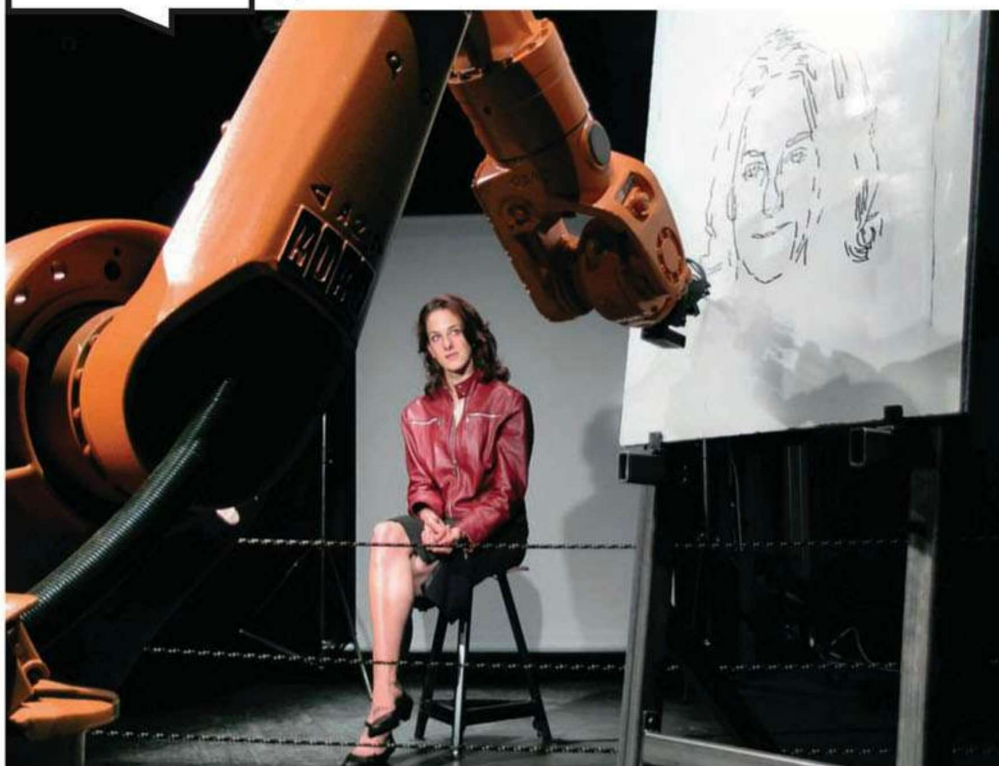


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NEWS BRIEF



VIDEO > Visit www.popularmechanics.co.za to catch the portrait-sketching robot in action.

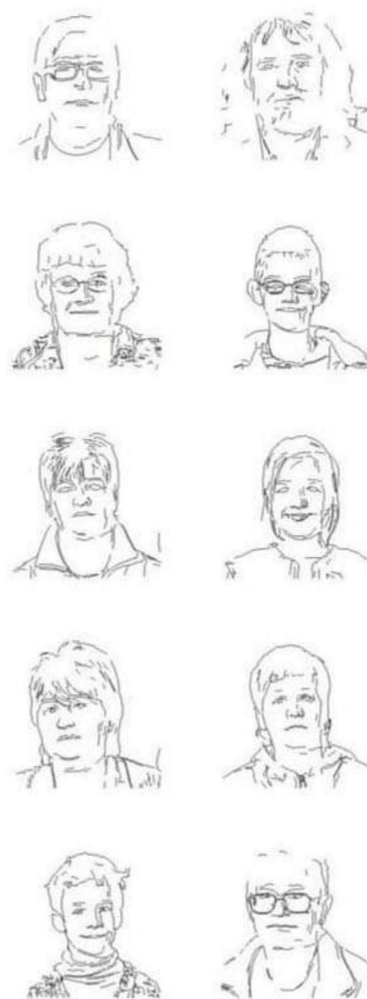


Pencil pusher

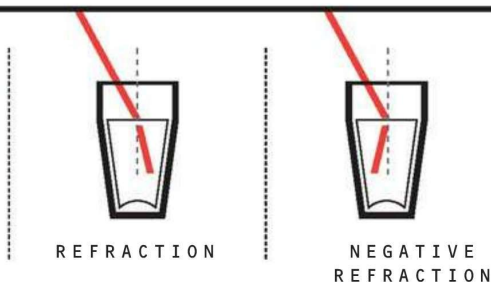
A REPURPOSED ROBOT FINDS A NEW CAREER IN PORTRAITURE.

BY ALEX HUTCHINSON

AN INDUSTRIAL MACHINE has abandoned its day job to become an artist. Researchers at the Centre for Art and Media in Karlsruhe, Germany, have taught a robot normally used to analyse the optical reflection of materials such as car paint or safety vests to render portraits. The robot records an image with its camera, then applies edge-processing software to search for key facial lines. It sketches those in pencil, producing a reasonable likeness in roughly 10 minutes.



THE ROBOT'S GALLERY



Negative refraction

When light passes from one medium into another, it changes direction, or refracts, in a predictable way. (Put a finger in a glass of water and it appears to bend.) Researchers at Oregon State University have developed a way to make low-cost material that will bend light in the opposite direction, a concept known as negative refraction. The material is composed of smooth, ultra-thin layers of custom-made glass arranged in a sandwich structure that manipulates the light.

What is the material good for? Researchers say that controlling negative refraction will permit the development of superlenses that magnify objects too small to see with a conventional optical microscope. — AH

Goldilocks effect

Long before babies understand the story of Goldilocks, they have more than mastered the fairy tale heroine's method of decision-making, say scientists. Infants ignore information that is too simple or too complex, focusing instead on situations that are "just right", according to a study published in the journal *PLoS ONE*.

Dubbed the "Goldilocks effect" by the University of Rochester team that discovered it, the attention pattern sheds light on how babies learn to make sense of a world full of complex sights, sounds and movements. The findings could have broad implications for human learning at all ages and could lead to tools for earlier diagnosis of attention-related disabilities such as ADHD or autism.

Source: University of Rochester



PM

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GET AHEAD WITH THE TIMES



H4

LED 3 x High End LED
Weight 85 g
Luminous Flux 45 lm*
Batteries 3 x AAA 1,5 V
Burning life 15 h**
Beam Distance 20 m*



H5

LED Power LED
Weight 116 g
Luminous Flux 25 lm*
Batteries 3 x AAA 1,5 V
Burning life 20 h**
Beam Distance 70 m*



H7

LED High End Power LED
Weight 117 g
Luminous Flux 170 lm*
Batteries 3 x AAA 1,5 V
Burning life 54 h**
Beam Distance 180 m*

AWARDS:



H7R

LED High End Power LED
Weight 120 g
Luminous Flux 170 lm*
Batteries 3 x AAA 1,5 V or NIMh 1.2V
Burning life 54 h**
Beam Distance 180 m*



H14

LED High End Power LED
Weight 348 g
Luminous Flux 210 lm*
Batteries 4 x AA 1,5 V
Burning life 13 h**
Beam Distance 210 m*

AWARDS:



H14R

LED High End Power LED
Weight 328 g
Luminous Flux 220 lm*
Batteries 4 x AA 1,5 V or NIMh 1.2V
Burning life 25 h**
Beam Distance 210 m*

* Luminous flux (lumens) and max beam distance (meters) are measured in the brightest function when switching on with new set of fresh alkaline batteries. These are average values and may vary +/- 15% depending on type of chip and batteries.

** Average hours of burning life as measured in the least energy-consuming mode and until residual luminous flux amounts to 1 lumen.

DIRECTIONS???

PFFFFFFT!!!!

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2 PIECE BIT KIT



SUPER TOOL® 300

19 TOOLS



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19 TOOLS

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18 TOOLS

3 PIECE BIT KIT



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GUTS, GLORY

AND MEGAPIXELS

THE GOPRO STORY – HOW AN ENTERPRISING SURFER WITH A TOUGH LITTLE CAMERA CREATED AN EMPIRE.

BY ROBERT MORITZ

PICTURES BY NATHANIEL WELCH

IT'S A FOGGY MORNING IN HALF MOON BAY, ABOUT 3 KM FROM THE LEGENDARY MAVERICKS SURF BREAK just south of San Francisco. The parking area is packed with 4x4s and other mud-splattered vehicles outfitted with surfboard and bike racks. I'm led inside the GoPro headquarters by Rick Loughery, the company's steel-jawed director of communications, who's wearing a T-shirt emblazoned with the words "manufacturing stoke".

We thread past a cube warren populated by twentysomethings dressed in the wrinkled cotton of passengers who just landed on the red-eye from Reykjavík (which some of the staffers very likely did). Duffel bags stuffed with outdoor gear crowd vacant desks while videographers stare into 68 cm monitors, editing footage captured at the most recent Winter X Games.

We weave our way to an office, where Nick Woodman, the 36-year-old founder and CEO of the upstart camera company, is double-fisting cans of Red Bull – his rocket fuel of choice – and watching a high-definition cavalcade of GoPro-sponsored athletes leaping out of aircraft, tumbling off mountains,

A full-page photograph of GoPro founder Nick Woodman. He is a man with short brown hair, wearing a black wetsuit, standing on a beach. He is holding a white surfboard vertically in front of him. A GoPro HD Hero2 camera is mounted on the nose of the surfboard. The surfboard has the GoPro logo and the slogan "Be a HERO." printed on it. The background shows a foggy coastline with waves breaking on the shore.

GoPro founder Nick Woodman with his HD Hero2 camera near the Mavericks surf break in Half Moon Bay, California.

plummeting over waterfalls and diving into hot tubs on every continent. The frenetic action has been stitched into a promotional video for the company's latest creation, the R2 400 HD Hero2, the culmination of a decade's worth of tiny, armoured cameras designed to be mounted on bike handlebars, snowboard helmets and car bonnets.

Woodman's distillation of the essence of the GoPro mission is equal parts corporate messaging and surferspeak: "Our goal was to create a celebration of inspired humans doing rad stuff around the world." In fact, Woodman is, to an extent, underselling the GoPro effect. The 8-year-old company not only has celebrated the antics of those inspired humans, it has also created a virtuous circle of video reinforcement that defines and motivates the culture of extreme sports.

Woodman – a wave rider, race-car driver, mountain biker and snowboarder – lives the lifestyle his indestructible cameras capture. He is proud that those cameras and accessories such as the new Wi-Fi BacPac, which adds remote capture and sharing features, form their own feedback loop that continuously adds functionality without stranding older equipment. The backward compatibility with cameras dating to the original HD Hero from 2009 keeps customers happy – and the Lego-like upgrades encourage people to buy deeper into the GoPro system. That resulting combination of customer enthusiasm and loyalty sold more than 800 000 cameras last year to users who then upload videos to YouTube once every 2½ minutes.

Woodman didn't set out to redefine the market for digital imaging. He just wanted to shoot decent surfing photos. In early 2002, after his games promotion company, Fun Bug, flamed out in the wake of the dot-com bust, he took off with his girlfriend (now wife), Jill, to surf-bum in Southeast Asia. The waves were world-class, and the art major from the University of California, San Diego, wanted to take high-quality action shots of his buddies on their boards. "Surfing is such an incredible experience with a huge ego element," he says. "Did you see that wave? I got so barrelled! No? You didn't!"

But unless you dragged a cameraman with a wide-angle lens into the tube with you, the best you could do was lash a disposable camera in waterproof housing to your arm with a rubber band. Woodman started thinking, what if I make a wrist strap with a mechanism that pivots the camera out of the way while I'm surfing, pop it up for the money shot, and then fold it down again?

Between paddling out for sets in Sumatra and Java, he spent his time creating prototypes from old surf leashes. When he and Jill returned to California in August 2002, they spent three months travelling the coast, living out of Woodman's 1974 VW Kombi

and selling bead-and-shell belts they had picked up for R15 apiece in Indonesia as R480 fashion accessories at concerts and flea markets. With the profits and a R280 000 family loan, Woodman continued refining his prototypes on his mother's sewing machine, moving back home to save money.

There was just one problem: the straps worked fine but the technology didn't. "Every camera I used would flood or break after a big wipeout," he says. "I realised I shouldn't be a strap company, but a camera company."

Woodman didn't seem to understand that switching from the sports-accessory industry to the consumer-electronics business (which is dominated by huge companies such as Sony, Canon, Nikon and Panasonic) is akin to going from intramural hoops to a professional basketball tryout. "Most businesses that enter categories like this don't bootstrap with one dude going to Starbucks every morning to, like, get himself pumped up for the day, saying, 'I am doing this!'," Woodman says, laughing at his lack of a strategic plan, team or money. "Looking back, it's crazy that we've gotten to where we are now."

Maybe not. It's unlikely that the HD Hero would have emerged from a digital-imaging company. The industry's leaders were busy trying to stuff more bells, whistles and megapixels into shiny cameras for the masses. No matter how obsessively he looked, Woodman could not find a camera he could transform into a tough-as-nails rig that would work in any kind of action. "I went to all the major camera shows, walking every aisle, and I'm maniacal," he says, "When I say I looked at every booth, I looked at every booth twice."

It took him two years to track down a Chinese company online that made an inexpensive, reusable camera for snorkellers and was willing to modify the design to accept strap mounts. Woodman's original camera used 35-mm film even as the rest of the market was swiftly moving to digital. He couldn't afford it at the time. And since he didn't know how to render a 3D CAD model, he made an old-school prototype, using a Dremel tool, plastic blocks and glue. He mailed it to China, wired R40 000, and crossed his fingers. "I had no idea if I was dealing with a real factory or a sham," he says.

It turned out the manufacturer was legit, and GoPro was in business. At an

'MOST BUSINESSES DON'T BOOTSTRAP WITH ONE DUDE GOING TO STARBUCKS TO GET HIMSELF PUMPED UP, SAYING, 'I AM DOING THIS!''



Woodman in 2002 with his father and his beloved (later, stolen) Volkswagen Kombi.



action-sports trade show in San Diego in 2004, the company landed its first customer: a Japanese distributor that ordered 100 cameras. (The celebration was tempered on the show's final night when Woodman's VW was stolen.) By 2005, GoPro still had only two employees – Nick and his buddy, Neil Dana. In 2006, the firm came out with its first Digital Hero camera, and Woodman fulfilled a lifelong dream by enrolling in motor racing school. He strapped a Digital Hero to the roll bar, but the punishing vibrations destroyed the camera's internal components and rattled the batteries off their connectors. The experience prompted a redesign that resulted in a product line that is essentially military-spec.

The phenomenon that truly launched GoPro was a collision of good timing and lucky engineering. In the autumn of 2006, Google bought a little company called YouTube, and by sheer dumb luck, the 3-megapixel Digital Hero 3 with VGA video launched in spring 2007.

"The name-brand cameras at the time didn't shoot very good video," Woodman says. "It was an afterthought, but within four months, the market had shifted. Our consumers and retailers went from asking, 'How's the photo quality?', for which we had an okay answer, to 'How's the video quality?', for which we had a great answer." Thanks to YouTube, sales tripled that year and have continued at a similar pace ever since.

But taking high-quality video is only half the equation for GoPro's success. To make videos worth watching, a camera has to get where the action is. The Hero was designed to be a great camera for surfers, but it turns out the qualities of a good surf camera translate perfectly to other action sports. GoPros are small, light and waterproof – and their signature wide, nearly fish-eye lenses seem to magically make subjects look, well, more heroic than they might otherwise be. That wide lens shoots your knees and skis, or your hands on the handlebars of a bike. The result is a big, immersive, ego-enhancing image.

GoPro cameras are structurally designed to flip the traditional relationship of cameraman to subject, aligning it more closely with the way people shoot video in the YouTube era. The cameraman is the protagonist of his own video, and the lens stretches wide enough to fit in both him and the world he is conquering.

GOPRO'S GREATEST HITS

By Michael Frank

MOUNTAIN BIKER TAKEN OUT BY ANTELOPE

Plot: A pro mountain biker in South Africa is bowled over by a red hartebeest, leaving him writhing in pain.

Fast-forward to... Don't. Stay for all 75 seconds.

Views: 13,5 million.



KAYAKING WITH REDONDO BEACH BLUE WHALES

Plot: Close-ups of the world's largest mammals.

Fast-forward to... 2:15, when a kayaker dives into the ocean to get even closer.

Views: 1,3 million.



SEAGULL STEALS GOPRO

Plot: Angry bird (singular) thinks a GoPro is a baguette in Cannes, France.

Fast-forward to 38 seconds, when the bird lands. Is this a hoax, though? How did the owner track the bird?

Views: 3 million.



JEB CORLISS AND ROBERTA MANCINO – WINGSUIT FLIERS

Plot: The death-defying love story of two people who jump off cliffs and fly.

Fast-forward to... 8:15, when Corliss, flying at 190 km/h, nearly knocks down a colleague on the ground.

Views: 24 000.

And now the professional crowd has grown to love Heroes. Emmy-winning cameraman Andy Casagrande IV has used them to capture everything from the inside of a shark's kisser to the inside of a lion pride. "GoPro is revolutionising wildlife filmmaking," he says.

For Discovery Channel's Shark Week, Casagrande created the Bite Cam (two Heroes embedded in a foam decoy) to capture the perspective of a seal as it's being devoured. "Before GoPro, no other cameras offered anywhere near the quality we needed. And since they're (relatively) cheap, the film industry treats them as nearly disposable cameras."

Based on data supplied by its retail partners, GoPro estimates that it owns 90 per cent of the rugged camera market, which is the place you want to be if you're trying to sell a device that records video. "In a camcorder market that declined by 30 per cent in the 12 months ending February 2012, the waterproof/rugged sector in which GoPro plays rose by 75 per cent in revenue," says Liz Cutting, senior imaging analyst at NPD Group, a market research company.

To see how completely the company dominates the rugged camera market and to understand its influence on action sports, search the term "GoPro" on YouTube. The result: clip after clip of awe-inspiring F/A-18 Hornet rides, avalanche cliff jumps, supercross races – all shot by users. (A search for "Nikon" produces page after page of product reviews.)

This is no accident. GoPro employs a social media team charged with nurturing its customer base via daily giveaways and prominent exposure on GoPro.com, Facebook and YouTube. What the company seems to understand better than its competitors is that a customer showing off what he did with his Hero on YouTube is far more valuable than a clip of him talking about his camera.

Today Woodman and company cater to their fan base with an ever-increasing number of mounts for snow, skate, bike, moto, and virtually any sport in their adrenaline-fuelled world. That's consistent with how Woodman sees GoPro, as the maker of exceedingly rugged building blocks that let customers invent how they shoot, not just what they shoot. Woodman – who wore head-mounted Heroes when his kids were born – imagines a surgeon using a custom capture device in the OR that riffs off something a kite surfer devised.

If it all sounds a bit far-fetched, consider that this vision is already playing out. The first step was the 3D Hero System – which uses the built-in Hero Port to combine two 2D cameras into a single 3D device. The new Wi-Fi BacPac allows a smartphone to monitor, control and stream video from up to 50 cameras. It's all part of Woodman's passionate "go big or go home" mindset, which is at the core of the GoPro DNA.

It's what inspires the brand's loyal users to shoot and share their most intense moments, and it may be the secret ingredient for the company to out-manoeuvre Sony, Canon, and Apple in the not-too-distant future. "You have to strive to be a top player or you shouldn't bother doing this in the first place," Woodman says. "If you're just muddling along, you're going to get smoked."

PM

Inventors... stand up!

You are cordially INVITED to enter our competition and stand a chance of becoming South Africa's **Inventor of the Year** for 2012. We're now accepting entries for the **POPULAR MECHANICS** Inventor of the Year competition, our annual showcase of original ideas in two categories: **Emerging Genius** (previously disadvantaged and minimally resourced entrants) and **Cutting Edge** (open to anyone).

Generous prizes are on offer in each category, and the overall winner will be declared South Africa's **Inventor of the Year** for 2012, walking off with a floating trophy plus a large cash award in recognition of his or her achievement.

RULES? There are a few, but we've done our best to make it as easy as possible. For example, your invention

must be your own, original work, and it must be fresh (in other words, don't submit something that was featured in your local newspaper 20 years ago). It should also serve a genuine purpose: whereas you might believe a combination nose-hair clipper and tea strainer is exactly what the world needs, you're probably wrong. And finally, keep it real: your rough sketch of a fusion-powered bicycle won't cut it.

WHAT'S YOUR NEXT MOVE?

Start working on your entry right now – but first, *do your homework*. Research it on the Web to make sure your invention isn't replicating someone else's idea (you'd be surprised), gather all the relevant information on your target market, and if possible, build a working prototype (there's nothing

quite as reassuring to a judging panel as an invention that clearly works). For entry forms and the "rules of engagement", please visit our Web site at www.popularmechanics.co.za or send your entry to invent2012@ramsaymedia.co.za



iStockphoto/N design

Popular Mechanics

BE THE FIRST TO KNOW

EMERGING GENIUS

CUTTING EDGE

**> LEAP INTO LIFE
WITH CONFIDENCE**



A Toshiba Satellite laptop is shown open, displaying a blue robot flying over a city skyline. The laptop is silver and black, with the Toshiba logo visible on the bezel. The background is a blurred cityscape.

[illegible]

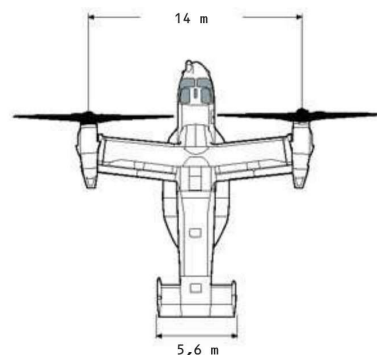
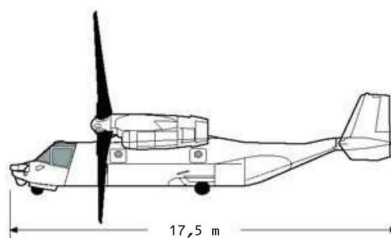
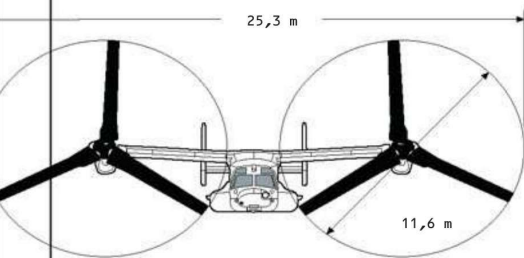
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THE V-22 OSPREY, HAUNTED BY FATAL TEST FLIGHTS, IS REDEEMING ITSELF IN COMBAT. BUT THE BATTLE TO PROVE IT'S AFFORDABLE IS FAR FROM OVER.

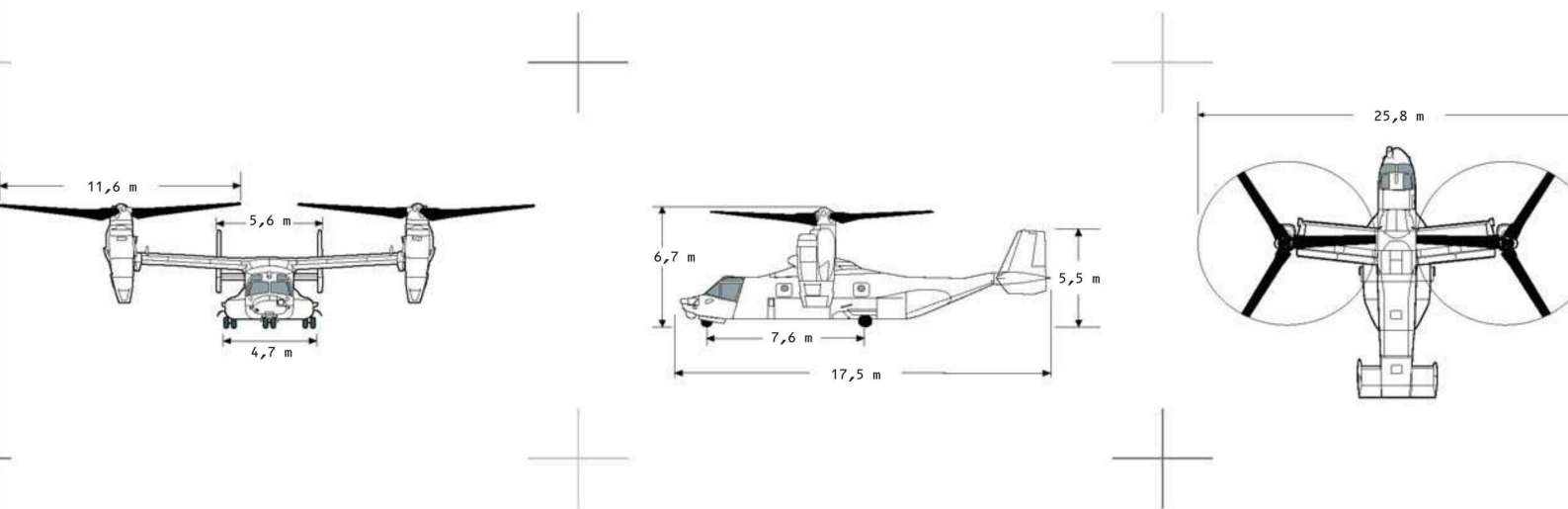
BY JOE PAPPALARDO

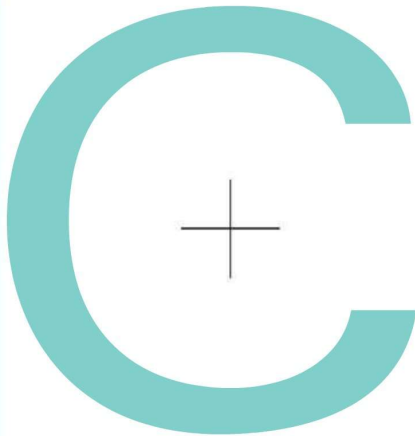
PICTURES BY JUSTIN FANTL





An MV-22, prop-rotors folded for stowage, sits on the flight line at Marine Corps Air Station Miramar.





CAPTAIN Art "Papi" Guzman, gaze fixed forward, strides through the hangar at Marine Corps Air Station Miramar in San Diego. The stoic pilot is focused on the day's mission. His hard, square face probably wouldn't flinch if a tennis ball bounced off his forehead.

Guzman must haul 3 900 kilograms of high-octane aviation fuel 150 kilometres north, over the peaks of the Chocolate Mountains. The trip will take 20 minutes. A half-hour after landing, the two Marines riding in the back will convert an empty patch of desert into a refuelling station for Cobra attack helicopters that are conducting live-fire rocket practice.

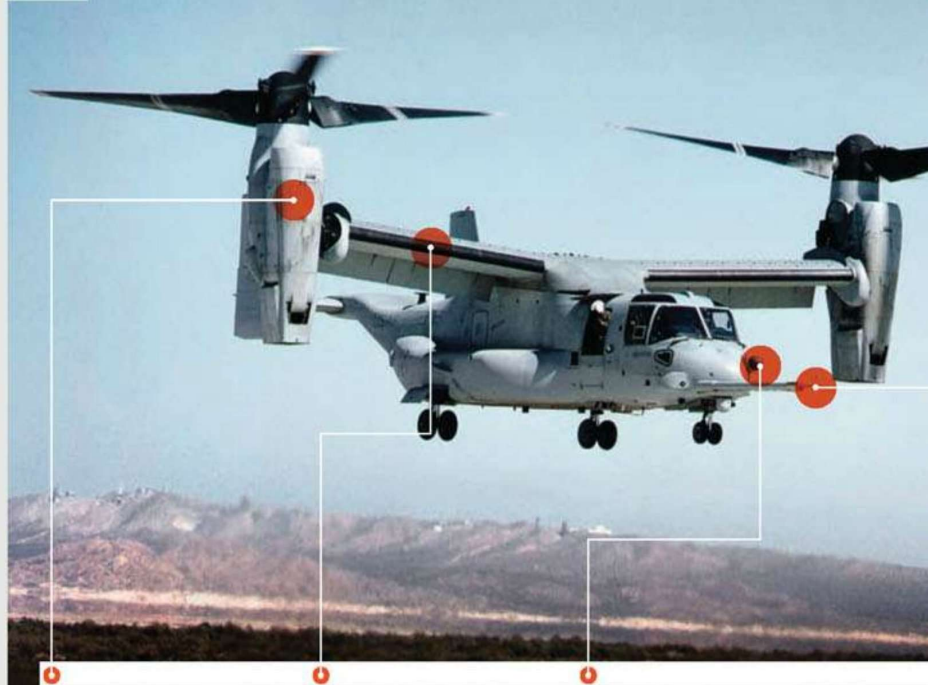
This training mission is ideal for Guzman's ride. An MV-22 Osprey can carry 9 000 kg of cargo (or 24 troops) internally. No other comparable helicopter can deliver this much fuel as quickly; the V-22 goes twice as fast as the tandem-rotor CH-46E Sea Knight and it can transport nearly three times the payload.

What makes the Osprey unique is its ability to tilt its rotors, producing more lift than thrust, which enables this plane to hover and fly like a helicopter. Two Rolls-Royce AE 1107C-Liberty engines, each delivering 4 590 shaft kilowatts, are mounted within nacelles at the tip of each wing. Those nacelles can rotate 11,5-metre-diameter propellers between 0 and 96 degrees in as little as 12 seconds. "Anytime I'm in helo mode," Guzman says, "I want to go faster."

Two Ospreys have been charged with completing today's task; VMM-161, the Greyhawks, are training for an upcoming mission to Afghanistan and the squadron needs flight time. Under a leaden sky that promises more rain, Guzman's co-pilot and ground crews

ANATOMY

SPECIAL OPERATIONS CV-22 OSPREY



NACELLES

The most audacious feature of both versions is the engines, mounted on the ends of the wings and designed to pivot, so the aircraft can fly in aeroplane and helicopter modes. Pilots manipulate a thumb wheel to adjust the angle of the nacelles, which move in tandem.

FUEL TANKS

One way a special operations Osprey differs from the Marine Corps variant is the extra fuel tanks. The CV-22 was built with four additional fuel tanks in its wings. Auxiliary tanks can be rolled onboard both versions for extra range.

MULTIMODE RADAR

The round bulge at the nose of a CV-22 is a multimode radar, which serves primarily as a terrain-avoidance system. MMR also features a mode that provides real-time weather data. (The Marines have just finished testing a weather radar for the MV-22.)

COMBAT RADIUS



The MV-22 carries almost three times the payload of the CH-46E Sea Knight helicopters it is replacing. The combat radius is more than four times that of the older Marine helicopter.

are prepping the Ospreys. Their rotors start to spin, the wash tracing intricate patterns on the rainwater pooled on the tarmac.

COSTS AND BENEFITS

No other modern military aircraft evokes the reaction generated by the Osprey. It's an engineering marvel and a target of abuse. Crusading bloggers and politicians denigrate it; pilots and military brass say it is revolutionising the concept of air mobility. Regardless, the aircraft is here to stay. The US Marine Corps and the Air Force Special Operations

Picture by ALAMY



Two services utilise the Osprey: The Marine Corps uses the MV-22 and Air Force Special operations command uses the CV-22. The aircraft are nearly identical, but each has several distinguishing features.

REFUELLING PROBE

The CV-22 can fly 900 kilometres on a full tank. But it often needs to refuel on return flights from long missions. In the cockpit, a Traffic Collision Avoidance System supplies the refuelling tanker's altitude and climb/descent information.



Command both use Ospreys, and both will receive more for years to come.

With its ability to shape-shift, the V-22 is a complicated aircraft. Kilometres of hydraulic and fuel lines run through the wings, and the fuselage must be tough enough to resist deformation despite the movement of the two 440-kilogram engines. Adding to the challenge, the propellers must fold so the V-22 can operate from ships.

A litany of problems – leaking hydraulics, onboard fires and, in certain conditions, aeronautic instability – plagued the aircraft during its 30-year development. This troubled programme took a human toll: 30 Marines were killed in three crashes during testing. Engineers have systematically addressed the plane's design flaws (see "A Legacy of Fixes"), but the media piled on to what they saw as an obvious villain; the abuse reached a peak in 2007, when a *Time* magazine cover story labelled the Osprey "A Flying Shame".

The stigma still lingers. In the past year the *New York Times* editorial board has denounced the V-22 as "accident-prone" and "unsafe". An April MV-22 crash during a training exercise in Morocco that killed two Marines will likely feed into this reputation.

But since its 2007 deployment the Osprey has proved to be safe while flying in some of the most inhospitable conditions imaginable. There has

been only one fatal crash in combat: in 2010 in Afghanistan an Air Force CV-22 touched down short of its landing zone, hit a ditch and flipped, killing four of the 20 aboard. "Over 10 years, Ospreys have been the Corps' safest combat rotorcraft," says Richard Whittle, author of *The Dream Machine: The Untold History of the Notorious V-22 Osprey*.

The advantages that the Osprey brings to the battlefield have been displayed during deployment. Not only can V-22s carry larger payloads, but they can also cover more than four times the distance of the Sea Knight. For the Marines and special operators who rely on the Osprey's speed, those are crucial capabilities.

In 2010, a helicopter was wrecked during a raid in Afghanistan, stranding dozens of special operations soldiers who came under attack from small arms and mortar fire. When other helicopters were turned

back by dust storms and the high peaks of the Hindu Kush, two CV-22s made the 1 500-kilometre rescue, soaring 4 500 metres and over the mountains. The mission returned 32 US personnel in less than 4 hours. A year later, an F-15 pilot who had crashed in Libya was rescued by MV-22s flying from an amphibious assault ship. The Marines returned the pilot to the vessel, 250 kilometres away, in just half an hour.

US Air Force Major Brian Luce, a pilot with the 8th Special Operations Squadron, flew the Osprey in Afghanistan and saw firsthand how it turned doubters into converts. "Some of the guys have a little hesitancy," he says. "But then they ride with us and get from point A to point B in record time." Luce says mission planners and combat commanders have also learned to appreciate the Osprey's capabilities. "The range and speed of a CV-22 are phenomenal," he says. "They are realising this and are adjusting their tactics and procedures."

Those benefits come at a steep price. The V-22's research and development programme was supposed to cost just over R300 billion, but independent estimates predict that it will come to R440 billion. This price tag – about R800 million per plane, including development costs – becomes a bullseye each time politicians look for budget cuts. The USA's 2010 bipartisan deficit commission proposed termination of the Osprey in its list of suggested savings.

The US government's proposed 2013 budget trims 24 aircraft (from 122 to 98) over five years, saving nearly R14 billion. But those orders could be reinstated during negotiations of the Pentagon's contract with Osprey maker Bell-Boeing. The fact that the Osprey has escaped the budget axe's deepest cuts confirms its improved reputation within the military.

Despite its successes, the V-22 still has something to prove. Critics have found another source of ammunition to aim at the hybrid aircraft that everyone loves to hate.

A MISSION DENIED

Guzman frowns at the darkening sky as he leaves the hangar. A cold rainstorm is lashing the area. The F/A-18s flying from the base have reported icing within a cloud layer between 1 500 and 5 000 metres. Those clouds are blocking the mission's flight path over the Chocolate

Mountains, which the pilots refer to as the Hill.

Most of the de-icing systems in the squadron's Ospreys are not working, placing the craft under Naval Air Systems Command-mandated restrictions that govern where Guzman can fly. This puts the mission in jeopardy.

"The amount of ice up there won't even degrade performance," Guzman says. "I could punch through to (5 000 metres) and it'd be a clear ride to the other side of the Hill." These rules are relaxed in combat zones, but extra precaution is taken during training flights.

Late last year a report by the Pentagon's Office of Operational Test and Evaluation noted that, from June 2007 to May 2010, the Marine Corps' Osprey mission-capable readiness was only 53 per cent.

"It's tough (for maintenance crews) to keep them flying," says VMM-161's commander, Lieutenant-Colonel Eric Gillard. "But people don't grasp that the V-22 is a leap ahead."

Guzman stalks to the flight line and heads for his Osprey. He climbs through the door behind the cockpit and enters the cargo bay. It is stuffed with a chest-high fuel container, pump and hoses that will become the temporary refuelling station for the Cobras. The walls are lined with tightly secured bundles of exposed wires and hydraulic lines.

Guzman enters the cockpit, nods at his co-pilot, sits in the right-side seat, and plugs in his headset. He is greeted with disappointing news: the mission has lost one bird to the malfunction of an auxiliary power unit. Another MV-22 will have to tag along later, following the mission's straggler plan. "This happens," Guzman says. "A lot."

The twin engines shake the aircraft as it prepares to rise. The graphite and glass fibre blades whirl just outside the cockpit windows, chopping air in a dark blur. Guzman's left hand moves the throttle control lever (which governs the pitch of the rotors) forward, and with hardly a lurch, the MV-22 rises into the grey sky.

The stubby windscreen wipers beat back sheets of rain as the aircraft climbs to 500 metres. After a few seconds Guzman plays his thumb across a wheel on the lever to change the angle of the nacelles.

Now in plane mode – with the nacelles

A LEGACY OF FIXES

The Osprey is not the same aircraft that was tested decades ago. Engineers have solved many of the problems that gave the aircraft its bad reputation.

	PROBLEM	UPDATE
HINKY HYDRAULICS	Titanium hydraulic lines leading to the nacelles used to rub against wire harnesses. This created holes in the lines that caused fires; in 2000, one such fire contributed to a crash that killed four Marines.	By 2005, the problematic hydraulic lines had been rerouted. They are now easier to access for evaluation and repair.
DANGEROUS DESCENTS	Rotorcraft that descend too quickly at slow speeds can lose lift if the rotor dips too far into its own downwash. This is called vortex ring state – an Osprey in VRS can lose lift on one side and flip; 19 Marines died in one such accident during the aircraft's development.	Ospreys have audio and visual warnings that alert pilots when VRS conditions start to form. Pilots can tilt the rotors forward to escape, if the aircraft has enough altitude to manoeuvre.
UNDERARMED FOR HOT LZs	Ospreys fly into landing zones that are defended by enemy fire (hot LZs). Critics once complained about the craft's lack of armaments.	Some Ospreys now have 7,62-mm GAU miniguns mounted in their bellies; they are remotely operated by the crew inside the aircraft.

ASK THE PILOT



CAN OSPREYS AUTOROTATE?

When a helicopter's engine fails, the rotors continue to turn as the craft plummets, which creates enough lift for the pilot to make a controlled landing. Ospreys cannot perform this manoeuvre, called autorotation. They have other ways to land in an emergency, says Special Operations pilot Brian Luce. V-22s can take advantage of the lift of the props and wings to set

down safely. "I'd look for a flat space and do a running landing," he says.

WHAT IF AN OSPREY LOSES AN ENGINE?

Each engine couples to another gearbox in the fuselage, so one engine can drive both rotors. "Unless I am very heavy or at a very high altitude," Luce says, "I can fly this thing single-engine all day, because of that interconnected driveshaft."

at 0 degrees, generating more thrust than lift – the Osprey climbs to 1 400 metres, skirting the lower edge of the weather system and ploughing east. The Marine pilot looks for a break in the clouds so he can zip through and drop to an ice-free altitude on the other side. But the clouds thicken and the rain smacks harder against the windscreen as the aircraft rises to meet the mountains. Visibility drops to scant metres. "There shouldn't be too much traffic up here," Guzman says to his co-pilot. "But keep your eyes peeled."

He descends to 1 000 metres, eyes constantly scanning the colourless mass. There's no way through. "Well, we tried," Guzman sighs into his headset.

Somewhere out in the desert, the Cobras are being refuelled – by trucks. "The plane flies great," Guzman says, "when everything works."

READY OR NOT

The same feats of engineering that make the Osprey such a gamechanger sap the aircraft's readiness for missions. Senator John McCain of Arizona,

a persistent Osprey critic, offered the following backhanded compliment last year as he lamented waste at the Pentagon from the floor of the Senate: "When it is not being repaired, the V-22 performs its missions impressively."

Maintainers point out that, compared with legacy systems, the Osprey is still new. There are decades of knowledge on how to best service an aircraft such as the Sea Knight, which has flown since the 1960s. Not so the V-22. "It's a new airframe and not too many people have worked on it," says Master Sergeant Simon Smith, a CV-22 maintainer based at Hurlburt Field near Pensacola, Florida. "We're still in the middle of our learning curve."

He hustles, clipboard in hand, across the flight line at Hurlburt, home of Air Force Special Operations Command (AFSOC). He's a busy guy – he will leave home for predeployment training for Afghanistan the next day to supervise the maintenance of Ospreys used on recent missions. "No telling how long I'll be gone," he says. "My bag's always packed."

The temporary duty assignment will be his 30th in 19 years. "Every time we change places, the environment adds different stresses on the airframe," he says. "The dust in Afghanistan clumps in different places than the dust in Iraq." These conditions play hell with the Osprey's performance. McCain cites Pentagon records that tally the V-22 engines' service life at just over 200 hours in Afghanistan. The military estimated that figure to be 500 to 600 hours. The shortfall has more

SENATOR JOHN MCCAIN OFFERED A BACKHANDED COMPLIMENT TO THE OSPREY: "WHEN IT IS NOT BEING REPAIRED, THE V-22 PERFORMS ITS MISSIONS IMPRESSIVELY."

than doubled the cost per flying hour to over R75 000, compared with about R35 000 per hour for the tandem-rotor CH-46 Sea Knight the Osprey was designed to replace, he said.

But those figures fail to account for the Osprey's speed and size. Whittle points to an internal Marine Corps analysis that crunches the numbers by passenger seats – 12 for the Sea Knight at a cost of R15 per seat per kilometre versus R8,50 for the 24-seat Osprey.

Special operations pilots like Luce say the maintainers are getting better with experience and that combat deployments have sped up the learning process. AFSOC does not release readiness rates, but at Hurlburt Field the CV-22 has earned a reputation as an attention hog yet gets decent reviews for readiness. "During my last three-month deployment (to Afghanistan), we never had to cancel a mission for maintenance," Luce says. "The maintenance force is definitely maturing."

He says the Osprey's notoriety is caused in part by its stature. "The CV-22 is high-visibility, sort of the flagship for AFSOC," he says. "It costs a lot of money, so people want to see results."

The struggle between capability and cost doesn't look the same on a spreadsheet as it does from the cockpit or an isolated landing zone. The truth is somewhere in between: the Osprey may be too costly to keep, but it's becoming too useful to abandon. **PM**

A Marine Corps maintenance crew works on the aircraft's prop-rotors. The blades are jointed so they can fold when the aircraft is stowed inside ships.





Illustration by Alex Griendling/Project plans courtesy of William Gurstelle

THE BOTTLE ROCKET

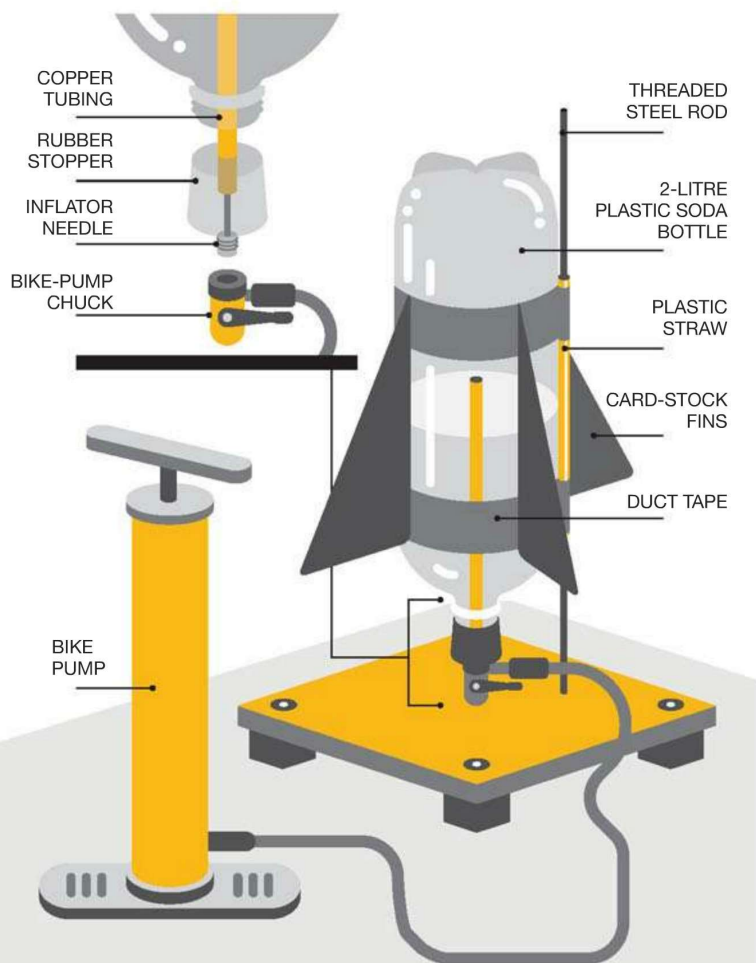
EARLY ADOPTER

Luke Larsen, 7, clamps the bicycle-pump head to the stopper assembly, preparing for lift-off. Luke's twin sister and father built the rocket together.

NEVER HAS LEARNING NEWTON'S THIRD LAW OF MOTION* BEEN SO MUCH FUN. MADE FROM A 2-LITRE SOFT DRINK BOTTLE AND PROPELLED BY A PLUME OF AIR AND WATER, THIS EASY-TO-BUILD ROCKET IS A FAMILY PROJECT THAT TURNS ANY AFTERNOON INTO A BLAST.

** To every action, there is an equal and opposite reaction. Here, the rocket rises due to a focused, downward release of water and pressurised air.*

BUILDING THE ROCKET



TOOLS AND MATERIALS

- ▷ Electric drill with 2-, 4-, and 6-mm bits
- ▷ Duct tape
- ▷ One No 4 size rubber stopper (25 mm long, 25-mm diameter at the fat end)
- ▷ One drinking straw, minimum 6-mm diameter
- ▷ One 20-cm length of 5-mm (outside diameter) copper tubing
- ▷ Four 25-mm-square wood blocks
- ▷ Bicycle pump with inflation needle
- ▷ One 12-mm plywood board, 300 to 400 mm square
- ▷ Heavy card stock
- ▷ One 6-mm threaded steel rod, 450 mm long
- ▷ One 2-litre plastic bottle
- ▷ Four 6-mm nuts
- ▷ Two washers, 6-mm hole, 25-mm diameter



The DIY family: Michael Larsen with his twins, Ada and Luke, 7, and wife, Tracy Talbert.

! SAFETY FIRST: parental supervision strongly advised for build and launch.

MAKE THE STOPPER ASSEMBLY

1. Drill a 2-mm hole through the middle of the stopper.
2. Widen the hole by drilling the 4-mm bit about 12 mm into the top (wider part) of the stopper.
3. Insert the copper tubing into the 4-mm hole.
4. Push the inflation needle into the hole in the bottom of the stopper so that it feeds into the copper tube.

BUILD THE ROCKET

5. Make fins from card stock; attach to the bottle with duct tape.
6. Tape the 20-cm drinking straw to the side of the bottle (oriented from top to bottom).

BUILD THE LAUNCHPAD

7. Attach square blocks to the corners of the launch platform (plywood), using quick-setting glue or 30 mm wood screws.
8. Place the rocket in the centre of the launch platform and mark the spot directly below the plastic straw.
9. Drill a 6-mm hole through the mark; insert the steel rod into the hole, and fix in place with nuts and washers.

PREPARE THE HYDRO-PUMP ROCKET FOR LAUNCH

10. Attach the bicycle pump to the inflation needle.
11. Fill bottle one-third full with water, below top of copper tube.
12. Push the stopper assembly firmly into bottle's mouth.
13. Invert the rocket and slide the soda straw on to the rod.

LAUNCH THE ROCKET

14. Pump air into the rocket. The amount of pressure required to fire the rocket will vary, depending on how clean the seal between the rubber stopper and the rocket is and how firmly the stopper is placed.
15. After several pumps, the pressure inside the rocket will be great enough to overcome the friction holding the stopper in place. Now comes the cool part, as the stopper releases from the rocket, and the rocket launches high into the air, shooting a trail of water behind it. Zoom!







*Standard on the Volvo S60, Volvo V60, Volvo S80, Volvo XC60 and Volvo XC70.



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What if your car could brake for you when you're distracted? City Safety* continuously scans the area in front of your vehicle to identify slower moving or stationary vehicles. If a collision is considered imminent, City Safety is automatically activated, applying the brakes and switching off the throttle to mitigate or avoid the collision. It's preventative safety technology that's **Designed Around You.**



Did you know that facing RDP houses north could save energy while pushing the room temperature up by 6 degrees in winter?

Well, that was one of the innovations at the *eta* Awards last year. Show us your bright new idea and how it saves energy, and you could win R30 000 in cash.

The *eta* Awards recognises and rewards innovative energy saving ideas from homeowners, children and small companies, all the way to big corporates.

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A BRIEF HISTORY OF THE ...

Surfboard

These days anyone can grab a surfboard and hang 10. Some even ride them down waves as tall as 10-storey buildings (dude!). From its humble wooden beginnings, we explore the surfboard's past – and look to its future.

BY ERIN MCCARTHY

CIRCA 500: Surfboards are to sixth-century Polynesians what Ferraris or giant flat-screen TVs are to consumers today – the ultimate status symbol. And size matters: tribal chiefs and nobles ride boards as long as 8 metres, while commoners catch waves on 2-metre jobs.

1778: During a stop in Hawaii, the crewmen of Captain James Cook's HMS *Discovery* become the first recorded Europeans to witness surfing.

"I GOT THE BOARD PLACED RIGHT, AND AT THE RIGHT MOMENT, TOO; BUT MISSED THE CONNECTION MYSELF. THE BOARD STRUCK THE SHORE IN THREE-QUARTERS OF A SECOND . . . AND I STRUCK THE BOTTOM ABOUT THE SAME TIME, WITH A COUPLE OF BARRELS OF WATER IN ME. NONE BUT NATIVES EVER MASTER THE ART OF SURF-BATHING THOROUGHLY." – MARK TWAIN, *ROUGHING IT*, 1872

1907: Surfing makes its mainland debut at an event for, weirdly, the railroad. Hawaiian George Freeth – who reinvigorated surfing by cutting his 5-metre redwood board to a more nimble 2,4 metres – demonstrates his skills in this publicity stunt for the Redondo-Los Angeles Railway.

1926: Tom Blake – who was born in Wisconsin and later moved to Hawaii – drills holes in his 5-metre redwood board to reduce its weight, then encases it in two other pieces of wood. His friends scoff at the "Cigar Board", but in 1930 a version of his super-fast board becomes the first ever to be mass-produced. Seven years later, he publishes plans for a DIY board in PM.

1932: The introduction of balsa decreases surfing board weights from 50 to 15 kilograms – which makes impressing beach bunnies by hoisting a board overhead much easier.



VIDEOS

> **FEBRUARY 2011** Visit www.popularmechanics.co.za to watch a video of the world's first surfboard with integrated technology.

> **NOVEMBER 2011** Visit www.popularmechanics.co.za to watch McNamara riding this mammoth wave.

1934: Hawaiian surfers taper the tail end of their boards; the new, more hydrodynamic design allows them to manoeuvre into the curl of the wave and ride in the pipe.

1935: Blake creates the fixed-tail fin, which increases manoeuvrability and stability. (Twin fins hit surfboards in the late '60s, triple fins in the early '80s.)

1940S TO '50S: Glass fibre, invented in the '30s, is used on surfboards after World War II. In the '50s, Hawaii's George Downing creates "gun" longboards: shaved polyurethane finished in glass fibre, the narrow, lightweight boards are ideal for big-wave riding.

"MY SURFER KNOTS ARE RISING / AND MY BOARD IS LOSING WAX / BUT THAT WON'T STOP ME, BABY / 'CAUSE YOU KNOW I'M COMING BACK... SURFIN' IS THE ONLY LIFE / THE ONLY WAY FOR ME." – BEACH BOYS, "SURFIN". 1961

1971: Sick of losing his board after wipe-outs, Californian Pat O'Neill (son of wetsuit designer Jack) comes up with a DIY solution: suction cup + surgical cord = surf leash.

FEBRUARY 2011: Spanish firms Tecnalia and Pukas equip a board with a gyroscope, an accelerometer, a GPS, and strain gauges to gather data. They find surfers experience up to 5 g's during sharp turns.

NOVEMBER 2011: Hawaiian Garrett McNamara rides a 27-metre wave – shattering the previous record, a mere 23 metres – off the coast of Nazaré, Portugal.

2012: Global Surf Industries layers glass fibre and hand-laid coconut husks over an expanded polystyrene core to create a surfboard (left) that is 25 per cent lighter – and 35 per cent stronger – than most other boards. Surfboards continue to get more high-tech, thanks to devices such as the WaveJet, a water-propulsion system that attaches to the bottom of boards and allows surfers to cut through water at up to 11 km/h. Using the device, McNamara paddled into a 15-metre wave; the only way to catch a breaker that big before was to be pulled in by jet ski. Gnarly!

GREAT STUFF

HERE'S THE NEWEST GEAR YOU'LL WANT TO OWN

COMPILED BY SEAN WOODS seanw@ramsaymedia.co.za



← PONG BEGONE

You may be able to live with footwear that accommodates multiple generations of odorous bacteria, but it could be tough on the rest of the household. Enter Stuffitts, a drying system for shoes that kills odours caused by perspiration and the depredations of the elements (you know, like rain).

It's suitable for all types of shoes, including boots.

What makes Stuffitts so effective is specially processed red cedar inserts – described by the distributors as a natural drying material with antimicrobial and anti-fungal properties. The firmly compacted cedar fill retains its functionality even when compressed, drying out when exposed to fresh air. They can be used on a daily basis for up to a year

before the inserts need to be replaced. Price: about R300. Contact distributors PortiTrex on 021-981 6444 or visit www.stuffitts.co.za

HEADS UP! →

Immersing yourself in a movie or game takes on a whole new meaning when you're wearing Sony's HMZ-T1 Personal 3D Viewer. Warning: this is a seriously addictive piece of kit. Once slipped on your noggin, it whisks you away to a virtual world that simulates a full-size (19 m) movie screen viewed from a distance of 20 metres. You also get four surround sound modes (cinema, game, music and standard) to further boggle your senses.

It features two OLED screens that display HD video independently, largely eliminating cross-talk and blurring for more comfortable 3D viewing. Because it uses OLED displays, you not only get a broader range of colours and brighter images, but also a super-fast response time of just 0,01 milliseconds, making it ideal for fast-paced sports or hard-core gaming. A processor unit allows you to connect to Blu-ray disc players, PlayStation 3 consoles and other devices. Price: about R9 000. Contact Sony SA on 011-690 3555 or visit www.sony.co.za



✓
Editor's
choice



SEE WHERE YOU'RE AT →

Boaters looking for a rugged, compact set of binoculars to accompany them on their travels are sure to appreciate Steiner's Navigator 7x30. It's waterproof to 2 m and filled with nitrogen to prevent fogging and condensation. Features include floating prism mounts to protect the delicate optical innards from knocks, SEBS professional rubber armour, an autofocus function (allowing you to keep everything sharp from 20 m to infinity) and an HD-stabilised, illuminated compass for that bit of extra safety on the high seas. Oh, and a 10-year warranty. Price: about R4 100. Contact SA Camera on 021-418 4885 or visit www.sacamera.co.za



STAY CONNECTED ↑

You may revel in the freedom of hitting the open road on two wheels, but do you have to do it in isolation? Short answer: no. It's time to embrace the Interphone F5, a real multimedia system for bikers. It allows you to connect with your mates while you're riding, hear GPS instructions, take and make cellphone calls, and even listen to stereo music (including FM radio with RDS). The intercom has a range of up to 1 200 m, but you can daisy-chain units for conference-type communication with up to six riders over a distance of 2,4 km.

Compatible with most GPS Bluetooth navigators, the Interphone F5 features voice-activated call/answer and call rejection commands. It can be installed on any helmet type (open-face, modular and full-face) and comes with a quick-release mechanism. It's also waterproof (IP 67-certified).

Price: about R5 000 for a double set and about R3 000 for a single unit. Contact The Gadget Shop on 012-346 2726 or visit www.thegadgetshop.co.za



SOLAR BEAUTY ↓

Using stored solar power to illuminate your property at night makes a lot of sense, but let's face it, some of the systems on the market are clearly inspired by function rather than form. On the other hand, the Solar Courtyard Lamp will undoubtedly get an approving nod from the "green" fashion police.

The cast aluminium lamp houses 66 super-bright LEDs that collectively deliver a useful 400 lumens, illuminating a radius of about 10 metres. The battery/panel box, formed from high-quality ABS plastic, can be pole-mounted (pole not included) or installed on any vertical surface. An 18-volt, 556 mA 10 W panel delivers solar energy to a 12V 7Ah lead acid rechargeable battery. The system is designed to reduce the power output by 50 per cent after five hours of continuous operation in order to save battery power; it also features an automatic day/night switch.

Price for the model shown here: about R1 500. Contact The Green Shop on 021-791 0821 or visit www.thegreenshop.co.za





ADVENTURE-PROOF SNAPPER ↑

As a rule, ruggedised compact cameras don't come cheap. However, if you're looking for a durable budget snapper to take along on your adventures, SeaLife's 9-megapixel Mini II dive and sport camera could work for you. Rubber-armoured and waterproof to 40 m, it can withstand a drop of 2 m on to hard concrete, making it ideal for recreational divers, snorkellers, boaters, hikers and paddlers.

An on-screen setup guide makes it easy to configure the camera to suit your subject matter and photographic conditions, after which you're set to capture great images on land or under water. There's even a "spy" mode that allows you to capture images at predetermined intervals (you know, for those occasions when your subject is unaccountable shy). It also captures 30 fps video, with sound. Price: about R2 850. Visit www.have2have.co.za

PROJECT YOUR IMAGE →

New accessories are being launched for the ubiquitous iPhone in such quick succession that users have barely managed to catch their breath. And here's another one – the i.Gear Lumio Projector, an appealing device that allows you to project data (videos, pictures, slideshows, etc) from your iPhone 4/4S on to just about any surface imaginable. Measured diagonally, the projected image can range in size up to 130 cm, using three LEDs as a light source.

But wait, there's more! Because it comes with its own Li-Ion battery, this mini-projector won't deplete your phone's battery, and it can even be used as a portable charger for your phone when you're out and about. It comes with an integrated loudspeaker. Price: about R3 000. Contact Mantality on 011-462 5482 or visit www.mantality.co.za



GET THE PARTY STARTED ↓

Looking for the ultimate docking station for your iPod? Well, if money's not an option (at R98 000, this baby doesn't come cheap), Wurlitzer's Model 1015 CD/iPod One More Time Jukebox could be for you. Measuring an impressive 151 cm high x 81 cm wide x 64 cm deep, and featuring a hand-finished wooden cabinet bedecked with chrome and rotating light columns that magically change colours, this retro-featured machine is bound to keep fellow revellers spellbound. The commercial-quality Philips CD changer can handle up to 100 CDs and, thanks to its Apple iPod connector, you can extend your music catalogue almost indefinitely at the touch of a button. If you like, you can remove the integrated Bose Acoustimass three-speaker sound system and mount it externally. Contact Mohan's Jukebox Company on 031-207 3266 or visit www.jukeco.com





← **PLUG 'N PLAY**

If you're into stylish gadgets such as Apple's iPad, iPhone and iPod range, it stands to reason that you'd want a classy docking station to match. That's where Philips' DC390 (for iPad/iPhone/iPod) comes in. Its chic aluminium housing can dock and charge any two devices simultaneously and its neodymium speaker driver delivers rich, clear sound. There's a digital tuner (so you can listen to the radio when the mood suits) as well as an MP3 link (so you can connect other portable media players). The clock automatically synchronises with your Apple product of choice within a few seconds, and a dual alarm feature allows you to set different wake-up times for weekdays or weekends, or vary the alarm times (in case of couples). Price: about R1 400. Contact distributor Drive Control Corporation on 011-201 8927 or visit www.drivecon.net

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MAKE IT YOUR OWN

Hardware hackers, not content with leaving their computers intact, are bound to appreciate HP's latest all-in-one PC, the Z1. That's because it snaps open, allowing you to swap out parts and make upgrades without special tools and, most importantly, without voiding the warranty.

It can be completely customised in terms of storage, with options including 7 200 and 10 000 r/min SATA, solid state drive (SSD), or an optional redundant array of independent disc (RAID) configurations up to 2 TB. Four dual in-line memory module slots allow for up to 32 GB ECC or 8 GB non-ECC DDR3 RAM. Input and output devices include PCI Express slots as well as USB 2.0 and 3.0 ports. You also get a 69 cm LED-backlit display, the latest generation of quad-core Intel Xeon processors, and professional NVIDIA Quadro graphics for blistering performance. Prices start from about R21 000. Contact distributor Drive Control Corporation on 011-201 8927 or visit www.drivecon.net

NO MESS, NO FUSS

Painting can be a frustrating, messy affair if you don't do it properly. Here's one way to make it go smoothly: use Bosch's new electric paint roller, the PPR250. It delivers a consistent and virtually drip-free flow of paint directly from the bucket to its 25 cm-wide paint roller, making it easy to paint large areas such as walls and ceilings. It's reportedly able to cover an area of 2 m² per minute, and can pump anything from 0 to 400 ml of paint in that time. It comes with a 5 m hose, so you won't be cut off from your supply. A universal tap connection allows for super-quick cleaning. Price: about R1 500. Contact Robert Bosch on 011-651 9802 or visit www.bosch.co.za



PLAY AND LEARN

Age-appropriate games are a great way to develop young and curious minds, and the LeapFrog Leapster Explorer – a portable gaming console – does just that. Suitable for children aged three and up, it presents educational content in a fun, interactive manner. Plus, it has buttons, a touch display and a stylus to help promote hand-eye co-ordination.

When you connect it to your PC for the first time, you can set up a parent account that allows you to track your child's progress in different learning touchstones and monitor how much time he or she spends playing certain games, allowing you to identify the child's strengths and weaknesses. Additional content can be downloaded from the LeapsterWorld Web site, where little ones can browse without "accidentally" using your credit card. Price: about R700. Contact Incredible Connection on 0860 011 700 or visit www.incredible.co.za

PM

Ask Mark

We know it's important to keep ahead of the techno game. Here, Mark Brookstone advises on making the most of your smartphone and give details of MTN's 2GB Internet bundle



I go online fairly regularly, and I need a package that will be good value for money on an ongoing basis. Can you recommend anything?

It sounds like your best bet is MTN's 2GB Internet package. This is available on a 24-month contract and costs R149 per month. It's a great package for ongoing Internet usage, and for anyone doing a fair amount of downloading. To find out more, *141*6# or visit www.mtn.co.za/selfservice. (Valid until 31 July 2012.)

I've heard that Google has a messaging service for MTN customers. How does this work?

The Gmail SMS Chat Service allows you to chat via Gmail from your computer directly to a mobile phone. The message can be answered from the phone, and will appear in the sender's original Gmail chat interface. For more information, visit mail.google.com

I'd like to find out more about MTN's Internet bundles, so that I can keep a check on my time – and spend – online.

With MTN's range of Internet Bundles, managing your spend becomes so much easier! Bundles range from R10 for 10MB to R189 for 2GB, and allow you to browse the web, check your email and chat to friends. The bigger the bundles, the lower the cost per MB. Loading an MTN Internet Bundle is easy – simply dial *141*6# on your phone and follow the prompts. (Valid until 31 July 2012.)

I need extra Internet speed on my smartphone, can you help?

Indeed I can! Well, the Opera Mini Browser (OMB) can. Thanks to its compression technology, you can get much more for your megabyte. MTN has partnered with Opera Mini Software, giving you

access to OMB. To download this free browser, visit <http://m.opera.com>. You can then purchase MTN's Opera Mini Internet Voucher for R35 which, together with the OMB, gives you even cheaper Internet. Simply dial *141*6#.

Mark suggests you also check out the following smartphone offers...

- The MTN Nokia Smartphone Service (R49) – offering you access to OVI mail, OVI IM and Nokia Maps.
- The MTN Smartphone Service for non-Nokia users (R49) – allowing you to explore the Internet from the comfort of your sofa.
- The MTN Social Networking Internet Service (R29) – giving you access to Facebook and MXiT via m.facebook.com and m.mxit.com.
- The MTN Opera Mini Browser (OMB) Internet Voucher (R35) – giving you an even cheaper Internet experience using OMB.

Dial *141*6# to find out more about any of these services.

Please note these smartphone services have a 30-day expiry period. Terms and conditions apply.

If you would like to find out more about MTN products that would best suit your needs, email us at askmark@tpsa.co.za. Please include 'Popular Mechanics' in the subject line of the mail.

For more information, visit www.mtn.co.za/internet or visit your nearest MTN store.



THE RUSSIANS

Glasnost notwithstanding, it's possible that you've never heard of a company called Russian Helicopters. You might not know that it accounts for some 13 per cent of the world's helicopter fleet – that's over 8 500 machines spread across 100 countries – and a formidable 27 per cent of installed attack helicopters globally. But if all goes according to plan, this manufacturer's name will soon become very familiar indeed.

BY ALAN DUGGAN

MOVING IN FOR A CLOSE-UP of the rocket launch tubes protruding from the helicopter's stubby wing, it suddenly hit me: there I was in the Russian heartland, photographing a deadly piece of military hardware, and no one was showing any interest in locking me up. In fact, everyone seemed to be smiling.

How times had changed, I remarked to one of our hosts, an amiable young man who had just remarked that he ranked Cape Town as the world's top travel destination. Back in the days of conscription, I confided, my old .303 Lee-Enfield and I had represented South Africa's sole protection from the invading communist hordes. He looked puzzled. "But why would we want to do that?" he asked. Nonplussed, the best answer I could produce was a lame "Well, you had to be there".

Diplomatic manoeuvring dispensed with, we proceeded to discuss the tough-as-nails helicopter market, an alarmingly unpredictable arena where politics and lobbying play a role just as critical as reliability and technological prowess.

Interestingly (and it has to be said that our



Below left: A formidably armed Mi-17-1BA in military configuration (think rockets, machine guns, cannons, and more). Middle: Built for multiple applications, including VIP transport, firefighting, search-and-rescue, and flying ambulance, the low-maintenance Mi-17 is the main product of the Kazan Helicopters factory. Right: Mi-38 prototype.



ARE COMING



VIDEO > Alan Duggan came back from the Russian Helicopters factory in Kazan, east of Moscow, with lots of cool video clips. Visit www.popularmechanics.co.za to watch our edited selection. Download wallpaper images of the helicopters and set them as your desktop background. (Search keywords: Russian Helicopters.)



A tight formation of multi-role Ansat helicopters passes over snowy wastes in the Russian hinterland. According to industry experts, these machines – capable of flying day or night, and in nasty weather conditions – rank among the most suitable helicopters for the African market. Ansat is a Tatar word meaning “easy” or “simple”.



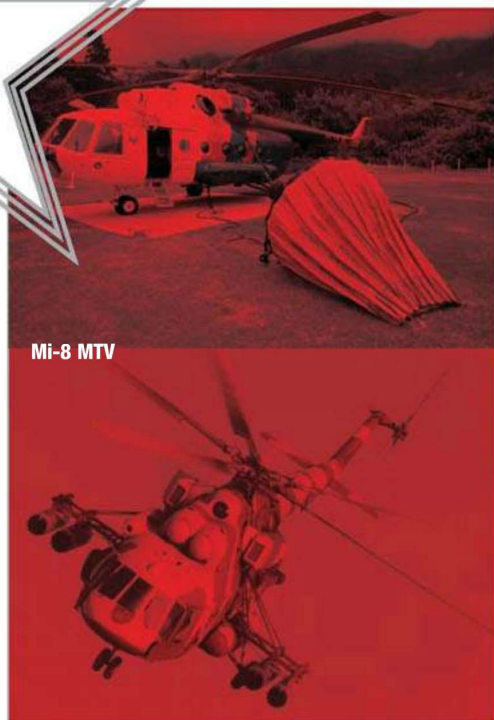
hosts were determinedly non-committal on the subject), the US military has recently found itself in a dilemma, having entered into a \$375 million contract for the purchase of 21 Russian-made Mi-17 helicopters for deployment in Afghanistan. This is a problem because Rosoboronexport, Russia's state-run arms trader, also supplies arms to Syria's President Bashar al-Assad, who is not exactly the world's most popular leader. The helicopters in question feature Western navigation and other equipment,

and reportedly work rather well in the extreme Afghan arena.

A report last year by analysts Frost & Sullivan said the global helicopter market across military and civil end-user segments was facing a growth in demand, reaching a potential market size of nearly 24 000 platforms in the period 2011 to 2020. The key factors contributing to this industry growth were upcoming replacement cycles in worldwide military and state-run fleets, growing disposable income in emerging

markets, and the structural growth of the global economy.

However, there are signs that this could change. Despite the expected growth for military helicopters, say Frost & Sullivan, the industry faces significant challenges – including defence budget cuts in some of the traditionally strong western markets as well as some emerging markets where end-users may be exercising caution in terms of procurement, both operationally and financially.



Mi-8 MTV

PLAYING WITH FIRE IN CAPE TOWN

Back in March 2004, PM writer Sean Woods spent a few illuminating hours with seasoned helicopter pilot Hugo Barnard, who devoted most of his flying time to putting out fires with the help of a Russian-built Mi-8 MTV and a so-called Bambi bucket – used for water-bombing mountain blazes – with a capacity of 3 000 litres.

Barnard swore by the versatile, “user-friendly” and ruggedly built Mi-8, introduced here in 1993, although he didn’t underestimate the risks involved in water-bombing fires, some of them spectacularly large. Among the critical challenges for the pilot: scooping up the water from a dam, reservoir or the sea; flying with a full load in gusty conditions; lining up the load for dumping; and finally, compensating – very quickly – for the reduced load after dropping the “bomb”.

Sadly, the Mi-8 no longer operates from the base in Cape Town’s Newlands Forest. As far as he knew, said a member of the National Parks staff, it had since been deployed in Afghanistan.

South African company Titan Helicopters has two of these machines in its fleet, the Mi-8 MTV (equipped with powerful TV3117VM engines and Western avionics and radio systems) and the slightly different Mi-8P, with a tail rotor positioned on the opposite side.



Above: A flight demonstration of the Ansat near the Kazan Helicopters plant, about 700 km east of Moscow. When journalists arrived at the site, loudspeakers were blaring out Wagner's stirring *Ride of the Valkyries*; they left to the accompaniment of Rimsky-Korsakov's *Flight of the Bumblebee*. Left and far left: Helicopters take shape in the factory at Kazan. Bottom: Another version of the Ansat.

Russian Helicopters is a Big League player in this multinational game, with credentials to match. It builds the legendary Mi-8 – if you live in Cape Town, you've probably witnessed its firefighting prowess during a Table Mountain blaze – as well as the heavy-lift Mi-26, a monstrous machine capable of hoisting 20 tons into the air (that's about the weight of 20 Citi Golfs), and the Mi-35M – billed as the only design that can be used as an attack and transport helicopter.

Arguably the biggest news from subsidiary Kazan Helicopters is the successful completion of the first demonstration flight of the multi-role Ansat helicopter with a hydro-mechanical flight control system. To date, Kazan Helicopters has produced two prototypes for aerial and ground-based testing. Russian Helicopters is currently marketing the civilian version of the twin-engine helicopter with the new

flight-control system, targeting its traditional markets across the CIS (Commonwealth of Independent States, former Soviet republics), South-East Asia, Africa, and Central and South America.

Here's the interesting bit: the company previously developed a version of the Ansat featuring a fly-by-wire (FBW) flight control system, but because no FBW civilian helicopter had been certificated before, there were no standard requirements to meet – and there it has stalled, at least for now. Says Kazan Helicopters General Director Vadim Ligay: "To avoid being dependent on certification of the FBW Ansat, we decided to offer the global market a helicopter with a traditional hydro-mechanical flight control system. We hope to obtain certification for this version of the helicopter in the second half of 2012." Meanwhile, the company will continue to develop the FBW version for the military.

It's been a long and occasionally rocky ride for this Russian company, which first began building aircraft in 1940, when it produced the first batch of Polikarpov Po-2 biplanes. Although they were hardly at the cutting edge of aviation – the Po-2s had wooden frames and fabric coverings – the factory continued to churn out these aircraft throughout the war years, eventually building over 11 000 – mostly for the Red Army.

Some of these were allocated to pilots of the 588th Night Bomber Regiment, all of whom were women, as were the ordnance loaders and mechanics. Although they were regarded more as nuisance raiders than a strategically important element of the Russian war machine, it seems the psychological effects of the night-time sorties had the desired effect on their German enemies, who began referring to the female pilots as *Nachthexen* or "night witches".

Marat Kiyama, the dry-humoured head of marketing at Kazan Helicopters, reveals that the famous Mi-8 has logged a total of over 5 million flying hours worldwide, a figure that would seem to support its reputation for durability. We're also told that the Kazan factory's main product – manufactured with the help of 7 000 employees and 1 500 sub-contractors – is the single-rotor Mi-17, a versatile and low-maintenance helicopter that comes in many guises: it can be equipped for passenger transport, search and rescue, firefighting, and even airborne surgery.

Kiyama pauses, then disarms us with a straight-faced apology. "I'm sorry," he says, "this is very boring. Disney is better."

It's not, actually.

PM





TAKING WING WITH SYNERGY

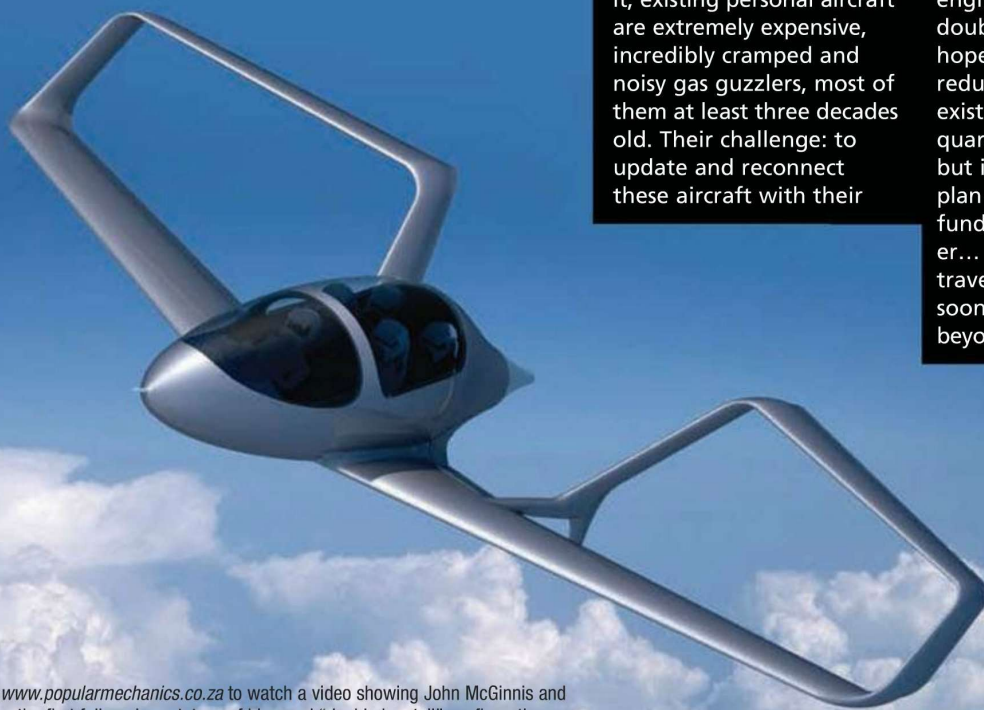
Time to overhaul the personal aircraft

Take three generations of craftsmen, throw in powerful engineering software, CNC machines, carbon fibre composites and an enthusiastic bunch of volunteers, and you could just end up with a small, affordable and very attractive aircraft. Meet *Synergy*, a flying machine that turns convention upside-down.

As designer John McGinnis and his team tell it, existing personal aircraft are extremely expensive, incredibly cramped and noisy gas guzzlers, most of them at least three decades old. Their challenge: to update and reconnect these aircraft with their

potential customers through a number of breakthrough technologies, thereby achieving massive savings in fuel consumption, a comfortable flight ("above the weather"), a greater range, and the ability to land at lower, safer speeds on local runways.

To achieve these goals, they've designed a curvaceous 5-seater featuring a multi-blade turboprop engine and an unusual double box tail, which it's hoped will substantially reduce drag. So far, it exists only in the form of a quarter-scale flying model, but if all goes according to plan – and their Kickstarter fund-raising campaign er... takes off – our air travel experience could soon be transformed beyond recognition. Or not.



VIDEO > Visit www.popularmechanics.co.za to watch a video showing John McGinnis and his team building the first full-scale prototype of his novel "double box tail" configuration.

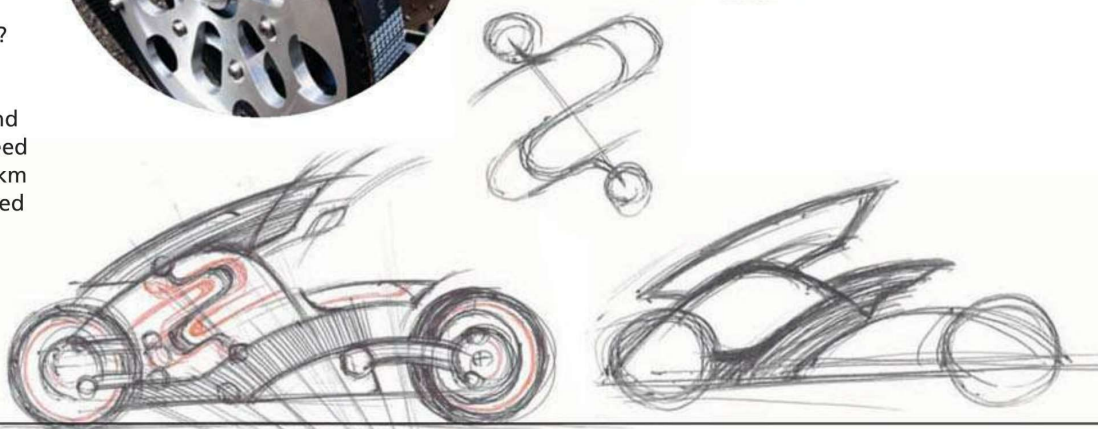


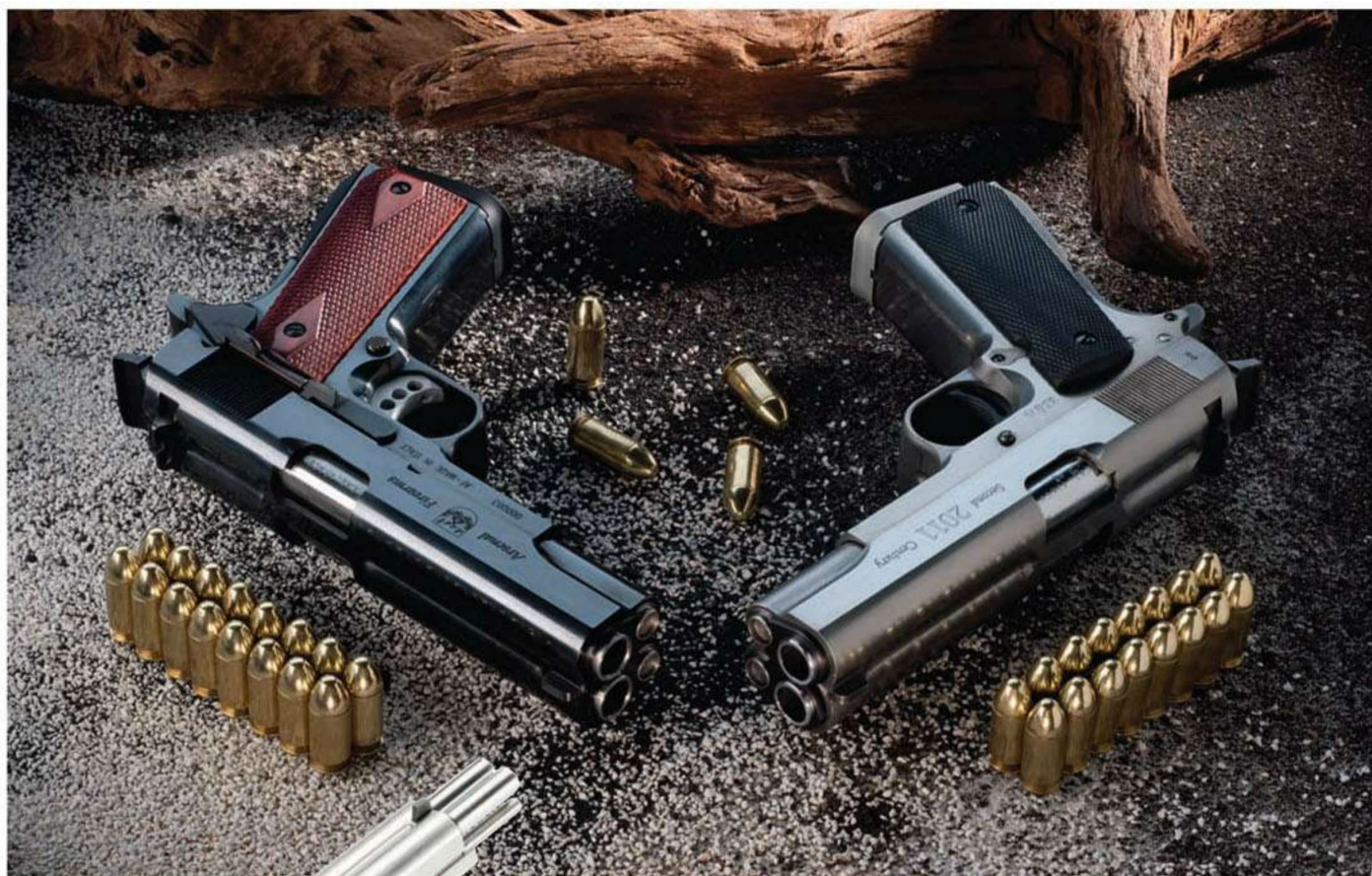
WEIRD NAME, COOL BIKE

Where's Batman when we need him?

Designed by the visionary Kota Nezu of Japan-based Znug Design, the oddly named and outrageously eye-catching zecOO – described by its creator as “an emotional electric low-ride motorcycle” – is reportedly destined for small-scale production. This already puts it ahead of competitors that exist only in someone’s fevered imagination (then again, can *anything* compete with a bike like this?).

Okay, so what’s different about it? In short, just about everything. We presume you’ve noticed the hub-centre steering, raked windshield and single-sided swingarm. What you need to know is that it can go up to 135 km between charges, and has a top speed of around 120 km/h. If this sounds a little underwhelming, we just know you’ll be impressed by the price tag – a formidable R500 000-plus. If exclusivity is your thing...





LETHAL WEAPON, TIMES TWO

Are you feeling lucky, punk?

Before you accuse us of glorifying deadly weapons, you need to know that we approach this kind of thing from the viewpoint of guys with an interest in, um, *guy stuff*; we're not advocating any kind of recidivist behaviour. That out of the way, we introduce the AF2011-A1, billed as the world's first series-produced double-barrel semi-automatic pistol.

According to manufacturer Arsenal Firearms, the design was inspired by the work of Swiss armourer Vivian Mueller, who cut and welded together parts of the Sig P210 pistol to create a long-slide, double-barrel 9 mm pistol that became a collector's piece (it apparently also worked very well).

Says Arsenal: "Our idea took the challenge further – to commemorate the legendary Colt 1911-A1 by making a market-ready double-barrel .45 calibre pistol." They achieved their goal within six months, producing an accurate firearm with formidable stopping power. Their words: "Two bullets with a total of 460 grains in weight impacting at 1 to 2 inches apart (about 2,5 to 5 cm) will knock down a bull, while the whole 18 bullets, for a payload exceeding 4 000 grains, can be delivered to the target in about three seconds."



VIDEO > Visit www.popularmechanics.co.za to catch the AF2011-A1 Double Barrel Pistol in action.

PLAY THE GAME

Looks, cred, power... what's not to like?

When multi-talented engineer Matthew Kim (he has a background as an architect and racecar designer) went shopping for a new computer, he was surprised to find that PC cases hadn't changed much in 20 years. Most were rectangular boxes featuring "the same tired internal layout with endlessly uncreative cosmetic variations" – so he decided to do something about it.

He explains: "I wanted to design something that would change the way people think about the computer... a technological jewel rather than an ordinary box, destined for a life of dusty obscurity. I wanted people to look at it and ask 'Ooh, what is that?' with a curious smile."

The result was the Hammerhead HMR989, a custom-built and strikingly different

machine that would make any gamer drool. It features an anodised aircraft aluminium frame, translucent Ecoresin panels with a Mil-Spec quick release system (motherboard side only), a formidable Intel Core i7-2600 Sandy Bridge 3,4 GHz CPU, USB 3.0, Micro ATX Intel Motherboard, 4 GB of RAM, a 40 GB solid state disc drive, a 1 TB front-loaded "hot-swappable" hard drive,

an nVidia ENGTX550 TI graphics card, an optical CD/DVD drive, and a Thermaltake Spin-Q CPU cooler. Price: about R24 000 in the US.

As Kim tells it, the Hammerhead is intended to outlast its internal components, and as long as the user is happy with the design, it can be easily upgraded with new components, "assimilating" such new technologies as a Borg drone.

PM



THE AUSTERE PRAIRIE
OF THE AMERICAN
MIDWEST IS THE
UNLIKELY CENTRE OF
ONE OF THE BIGGEST
OIL BOOMS IN DECADES.
BUT WILL DRILLING
HERE AND IN OTHER
DOMESTIC OIL PATCHES
HELP THE COUNTRY
MOVE CLOSER TO
THE ELUSIVE GOAL
OF ENERGY
INDEPENDENCE?

THE BIG PLAY

> BY JAMES VLAHOS
> PICTURES BY BENJAMIN LOWY



**Pumpjacks near
Tioga, North
Dakota, pull crude
from the Bakken
Formation. In 2012,
output from the
play – the industry
term for a hydro-
carbon-bearing
stratum – may turn
the state into the
USA's second-
biggest producer,
behind Texas.**



I am holding a rock that looks like an ice hockey puck, one so solid that a slap shot would result in a busted stick. It's 360 million years old. Long before dinosaurs roamed the Earth, zooplankton, algae, and sand accumulated on the bottom of a Devonian sea. Heat and pressure transformed the sediments into a layer of shale, which is now buried 3 kilometres beneath the windswept prairies of America's northern Great Plains. This stratigraphic layer is called the Bakken, and it is where the rock in my hand had rested, until very recently, in mute, stony peace. I'm standing inside one of the command posts for the Harvey, an oilwell in the North Dakota section of the Williston Basin, squeezed shoulder to shoulder with men in red jumpsuits. We're watching Jared Edvenson, who sits at a control panel, and waiting for him to trigger explosives.

These days, detonations of all kinds – social, economic and pyrotechnic – are “Rockin’ the Bakken”, as a popular local T-shirt puts it. The Bakken has inspired thousands of fortune seekers to head north in a modern-day version of the Klondike Gold Rush. It is responsible for minting millionaires but also for costing people their homes and, occasionally, their lives in oil rig accidents. It has contributed to the fear in some quarters that an environmental apocalypse is nigh, and the hope in others that the Americas, not the Middle East, will one day be the epicentre of the global energy supply. “Five years ago, you tell people you are working in North Dakota, and they would be like, what are you talking about?” says LeeDon Wiseman, the Harvey well’s lead consultant.

“Five years ago?” says a co-worker. “Last year even.”

“Now we’re on every world map there is,” Wiseman continues. “Bakken. It’s an explosion. Worldwide.”

In 2001, North Dakota wells produced 31 million barrels of oil, less than 2 per cent of which came from the Bakken. Last year the state generated a record 152 million barrels, and more than 80 per cent of it was Bakken-derived. For 2012, North Dakota’s output is projected to surpass that of California (196 million barrels) and possibly even that of Alaska (209 million barrels) and to lag behind only Texas (533 million barrels). Estimates for the total amount of oil that could be recovered from the formation range wildly, from a few billion barrels or less to exponentially more. In an unpublished but nonetheless widely referenced paper from 2000, Leigh Price of the United States Geological Survey estimated that 200 billion barrels of oil could ultimately be extracted.

The Bakken crude is exceptional, light and sweet. But it’s difficult to recover. The formation is broad, sprawling over 65 000 square kilometres beneath the US states of North Dakota and Montana and the Canadian states of Saskatchewan and Manitoba. It is also skinny, reaching a maximum thickness of only 50 metres. What’s more, the rock is dense, averaging 5 per cent or less porosity, which means that 95 per cent or more of the rock consists of just that – solid rock, rather than open pores that can hold oil. (Conventional oilfields, such as Saudi Arabia’s Ghawar, have porosity of up to 35 per cent.) Russell Rankin, a regional manager for Statoil, a multinational energy company and one of the owners of the Harvey, gestures toward my core sample. “You see that rock and say, ‘It looks like concrete,’” he says. “How do you get oil out of that?”

Part one of the answer is to employ horizontal drilling, which oil companies began trying here in the late 1980s. A couple of weeks before I arrived at the Harvey, the workers started by drilling straight down, just as they would traditionally. But then, as the bit approached the 3-km depth, the workers guided it on a graceful, 90-degree curve into the Bakken. From there they drilled horizontally for another 3 km, maximising the well bore’s access to the thin geological layer.

Part two of the answer is hydraulic fracturing, another technological

innovation. In the command-post truck, Edvenson stands by to initiate the first step in that process. A man’s voice crackles over a two-way radio. “We’re at 4 544 metres, you good?”

“I’m good,” Edvenson replies from his seat in front of the control panel. He turns a dial to amp up the electrical charge he’s about to unleash, lifts a red protective cover, and reaches for a toggle switch labelled SHOOT.



Local geologist Kathleen Neset and her husband, Roy, founded a consulting firm that helps petroleum companies at nearly half of North Dakota’s 200-plus active rigs locate oil-rich rock.

The Bakken boom is the biggest in North Dakota history, but it isn’t the first. Just ask Kathleen Neset. A New Jersey-bred, Brown University-educated geologist, Neset arrived at the height of the 1979 fuel crisis. Prices were soaring and oil companies were thirsty for North Dakota crude, even though it was costly to extract. Neset met her future husband, Roy, while they were working on a rig near the state capital Bismarck, and the couple launched a drilling and geological consultancy to help drillers locate the most oil-rich rock. But then the crisis ended, oil prices crashed, and “the state went from 146 active drilling rigs in 1981 to basically zero”, Neset says.

In the wake of the bust, Roy, Kathleen and their

two sons supported themselves mostly by working on their family farm, which had been homesteaded a century earlier by Roy's Norwegian ancestors. But then, in the late 1990s, their oilfield business began climbing again, and since 2008, it has skyrocketed. Today, the Neset Consulting Service has crews working on nearly half of the state's 200-plus active drilling rigs, and Kathleen Neset is one of the best-known women in the state's oil industry.

On a cold, clear day in February, Neset takes me to visit the farm, just outside the town of Tioga. After driving between golden fields of durum wheat, we reach a small hilltop, where a windbreak of ponderosa pines opens to reveal a white farmhouse. Oil was first discovered in North Dakota only a couple of dozen kilometres from here, in 1951, and behind the Neset farmhouse is a well that was drilled a few years later. Long since abandoned, the rusty artefact is a reminder that people have been trying to suck oil out of North Dakota for six decades, and its presence raises an obvious question: why has it taken until now for production to kick into overdrive?

"Well, we always knew the oil was here," Neset says. "But to get it out of the ground, we had to wait for the technology to catch up."

It was the chance to see the new technologies in action that had brought me to the Harvey well, about 80 kilometres southwest of Neset's farm. As I look on, Edvenson's fingertips find the shoot switch and flip it, triggering explosive charges 3 kilometres down in the Bakken layer. They blast a series of cracks that extend outward from the well bore and into the surrounding rock. This step – called perforating or perfring – doesn't release much oil; the cracks are only a couple of metres long and finger width. Rankin says perfring creates zones of weakness, and the next step is to attack them.

Rankin and I walk a few dozen paces to the frack van for another well, the Kari, which has already been perfring. Inside, well-site consultant Scott Bell shows me a sample tub of fracking solution, a beige

FRACKING THE BAKKEN

1

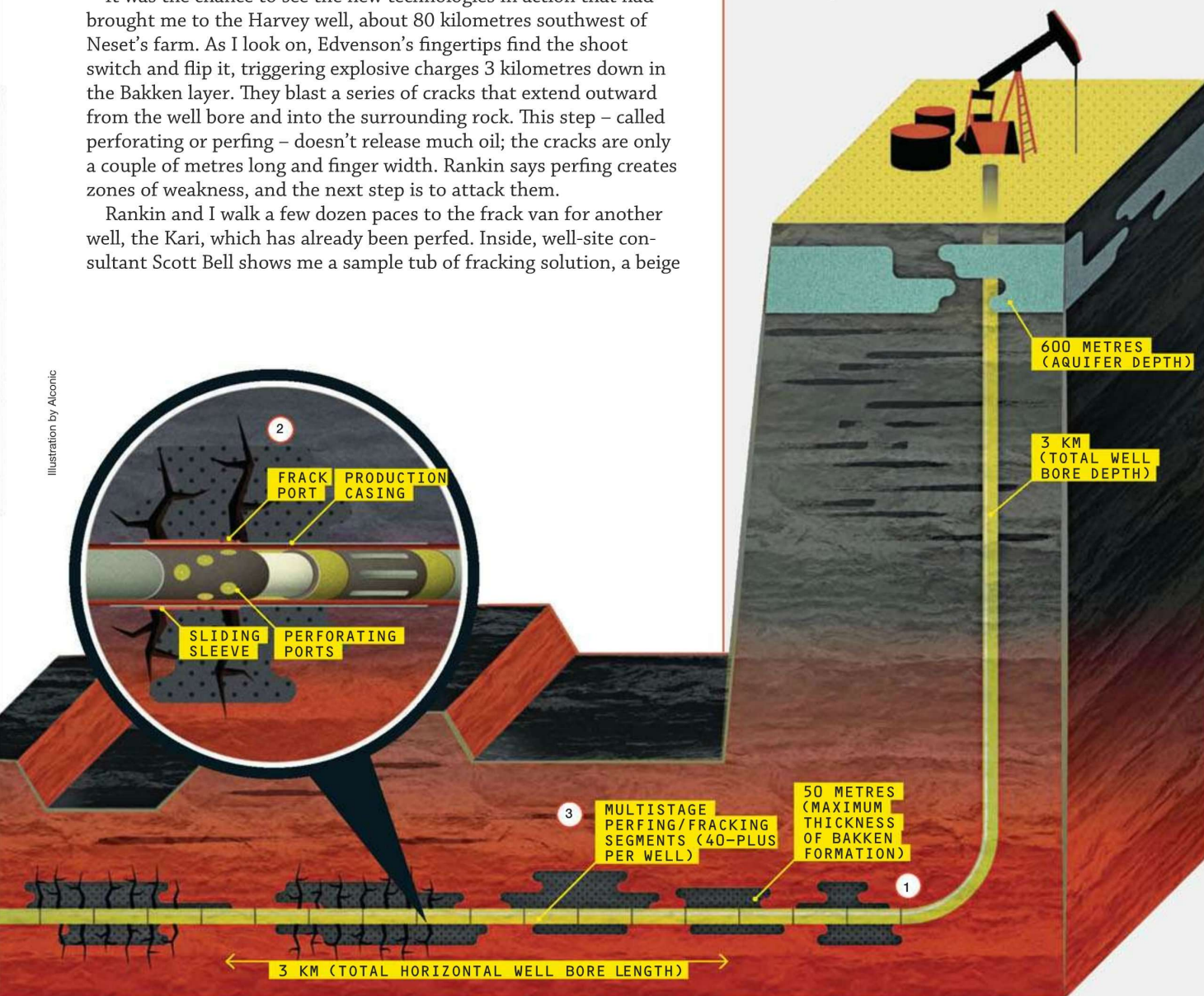
North Dakota's Bakken Formation is a layer of dense, oil-bearing rock found at a depth of about 3 kilometres. To tap it, oil companies drill to the hydrocarbon-rich stratum, then curve the well bore 90 degrees so that it runs horizontally through the thin, irregular formation.

2

Hydraulic fracturing, or fracking, typically frees oil by cracking rock with high-pressure bursts of water, sand and chemicals. Tight rock in shale-oil plays like the Bakken requires multistage fracking to maximise oil recovery.

3

In multistage fracking, engineers perforate short segments of the production casing independently. This allows them to concentrate the hydraulic assault, creating longer cracks that allow more oil to flow to the well.



NOT TO SCALE

goo consisting mostly of water and sand as well as chemicals that inhibit bacterial growth and enhance viscosity. Thousands of litres of the stuff are being pumped through hoses and deep into the well. The fracking solution then surges into the perforations, driving the cracks over a hundred metres outward from the bore. Bell and Rankin monitor the assault on a computer screen, watching as the pressure climbs to 450 bar. "She likes it, she likes it," Rankin says.

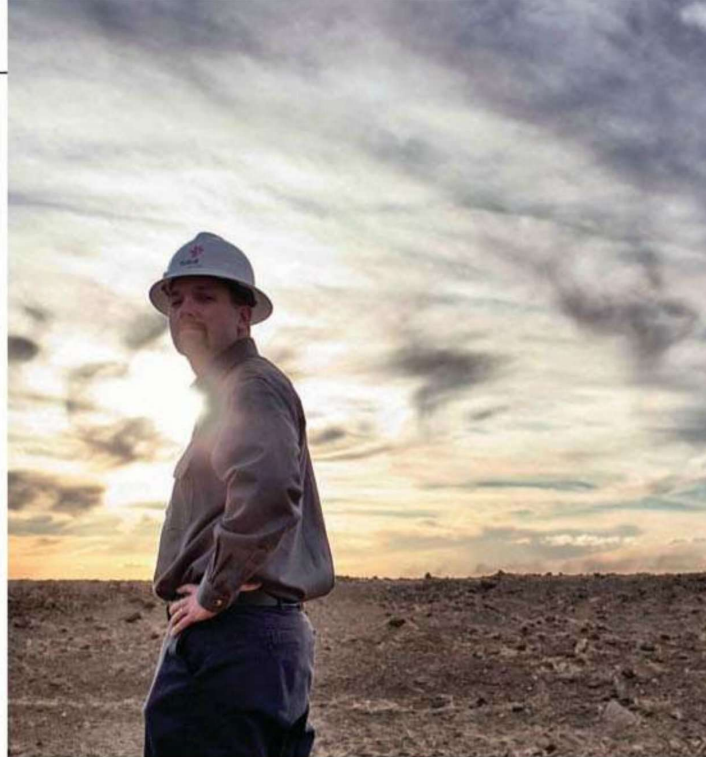
At this point, if Bell simply shut off the pumps, the cracks would snap shut again. Instead, his team changes the mixture of the fracking solution so that it carries tiny ceramic beads, called proppant. The proppant gets packed into the fractures and stays there, holding them open so that oil can flow freely to the bore.

Until a few years ago, wells were perfed, then fracked, in a single pass. Rankin calls this the Hail Mary approach. Now well pipes are subdivided into 40 segments or more, each of which is perfed and fracked in isolation, maximising the effectiveness of the hydraulic onslaught. "Multistage fracking has revolutionised the Bakken," Rankin says.

The new techniques have given rise to the current Bakken boom, but there are no guarantees that it, too, won't go bust like those of the past. Even when coaxed with the latest techniques, the formation is stingy about releasing hydrocarbons; for example, whereas production from a new well in a conventional oilfield declines about 5 to 8 per cent per year, the output from Bakken wells declines 65 per cent after the first year. Ultimately, even if the most wildly optimistic estimate of Bakken oil reserves is correct – around 200 billion barrels – the amount of oil that can actually be recovered may still be only 10 billion barrels or less.

The other uncertainty is the price of oil. Rankin says that drilling, which is more costly in the Bakken than it is in conventional fields, will be profitable even if prices drop to \$60 (about R470) a barrel. The Bakken play may thus sound like a safe bet, with prices currently topping \$100 a barrel. But as inflation-adjusted data from energy analyst James Williams of WTRG Economics indicate, oil prices have remained below \$60 a barrel for most of the years since World War II. If prices tumble back down toward their long-term historic norms, Neset may need to return to her crops once again.

Energy blogger Ken Paulman was surfing the Web last year when he came across a time-lapse video, recorded from the International Space Station, that took viewers on a soaring journey over the Earth at night. A geography buff, Paulman says he was puzzled when, in what should have been a blank spot on



THESE DAYS, DETONATIONS OF ALL KINDS – SOCIAL, ECONOMIC, AND PYROTECHNIC – ARE 'ROCKIN' THE BAKKEN' IN NORTH DAKOTA.

the US map, the lights of an enormous "mystery city" spun into view. He realised to his surprise that he was seeing the Williston Basin.

At the heart of the boom, the city of Williston in North Dakota has grown from 12 500 residents a decade ago to nearly 20 000. Driving around town, I'm flanked by tractor-trailers hauling water, sand and oil, and I pass intersections where city workers are stringing up new traffic lights. The Walmart is jammed with shoppers, and it takes half an hour for

▶ CONTINUING PAIN AT THE PUMP

Oil production is rising in the US and Canada, and American consumption is at an 11-year low. Yet petrol prices have not receded. Here's why. *Reporting by Joe Pappalardo*

GLOBAL COMPETITION

Steady demand from China and other booming economies is one reason why the price of crude oil reached record levels in early 2012. And, according to Amy Myers Jaffe, director of Rice University's Baker Institute Energy Forum, "Crude oil price is the single biggest influence on US retail (petrol)."

OVERSEAS UNREST

The price of crude is extremely sensitive to market disruptions. For example, when trouble looms in the Middle East, European nations seek more reliable suppliers, who then demand higher prices, which drives up costs for US refiners. "When people talk about attacking each other in the Middle East," Jaffe says, "it lifts the price of oil."

WEAK INFRASTRUCTURE

The increase in North American production has overwhelmed domestic shipment and storage infrastructure. The inability to move crude efficiently around the US has made some refineries reliant on Middle Eastern and African suppliers and therefore vulnerable to price spikes. Those increases are passed on to consumers at the pump.

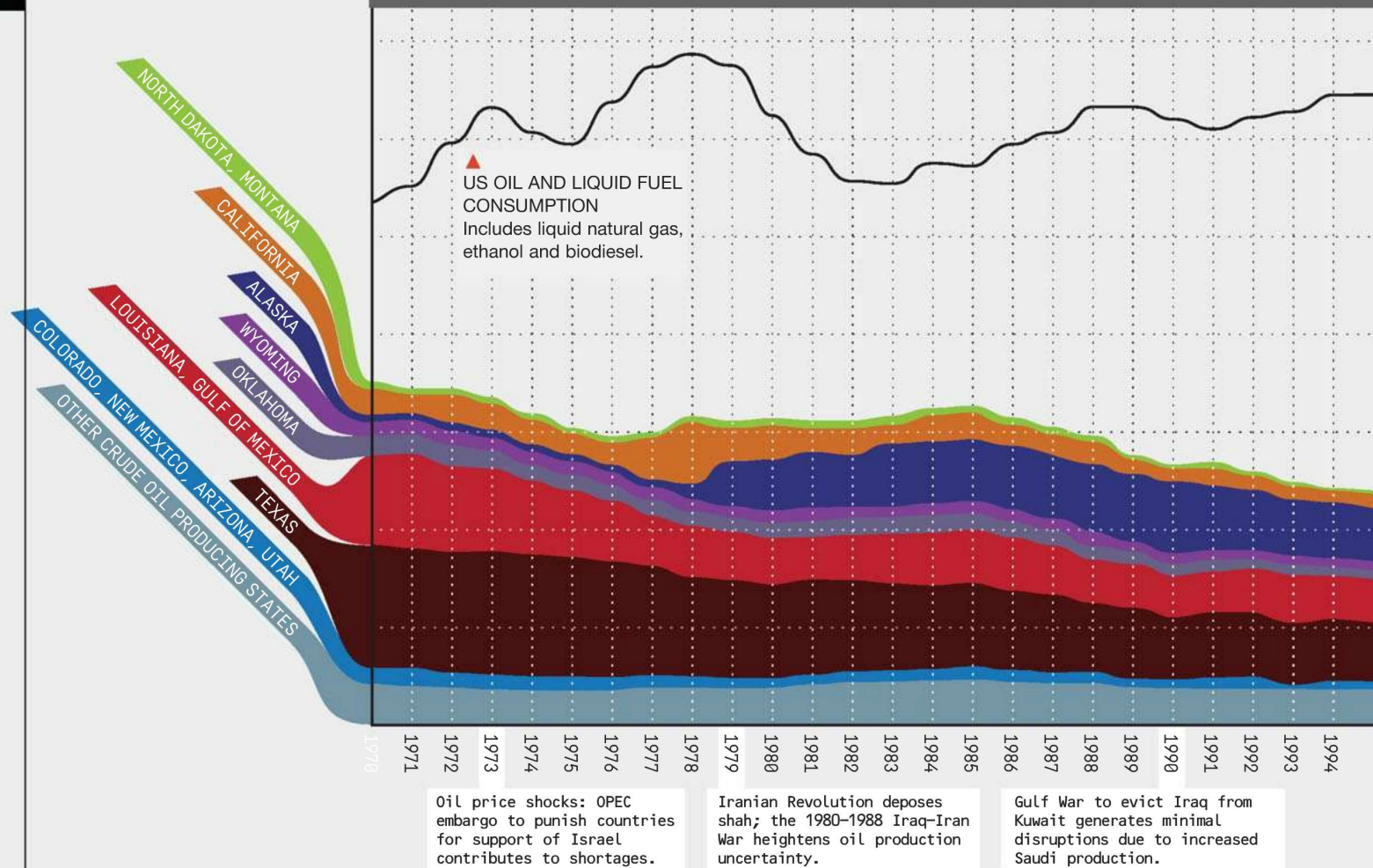
REGIONAL STANDARDS

Even if American refineries all had equal access to domestic crude, regional prices would still vary because of differences in city and state clean-air standards. These regulations lead to local production of boutique petrol, which drives up prices. In general, big cities have tougher standards, so urban drivers pay a bit more than rural ones.



This rig near Williston, North Dakota, drills down 3 kilometres to the Bakken Formation and then horizontally through the pay zone. Opposite: Statoil's Russell Rankin surveys a drill site outside Williston.

CAN THE US DECLARE ENERGY INDEPENDENCE?



US presidential candidates all agree on one point: the nation must end its reliance on foreign oil. As a candidate in 2008, Barack Obama promised to “eliminate the need for oil from the Middle East and Venezuela” in 10 years. Mitt Romney’s energy adviser agreed that a similar goal was attainable. Other politicians and pundits also claim that the US is marching toward energy independence; a recent pair of Citigroup reports offered specifics on how to reach that elusive goal. But how realistic are these expectations? PM examines the truth behind the numbers. *Reporting by Steve Rousseau*

OIL-INDEPENDENCE REALITY CHECK: CLOSING THE GAP

The 2012 Citigroup reports offer a best-case scenario on how the US could achieve energy independence by 2020.

SHALE OIL: 1,1 BILLION BARRELS/YEAR (B/YR)

To reach this figure by 2020 would mean a lot of drilling. Shale-oil plays tend to deplete far faster than conventional fields. The Bakken’s 25 per cent increase in output between 2009 and 2012 required nearly four times the number of wells, from

891 to 3 350. Another 25 per cent increase would drive the well count to at least 9 400.

OIL SANDS: 1,3 BILLION B/YR

The projection is based on output from Canadian oil sands. Even so, the Canadian Association of Petroleum Producers estimates that output will hit an annual total of only 1,1 billion barrels by 2020. But there’s no guarantee that this crude will not end up in China. “Market pull will draw supply,” CAPP spokesman Travis Davies says. Canada is

accelerating plans for a pipeline to ship crude from Alberta to a Pacific terminal, while environmental concerns delay pipelines to the US.

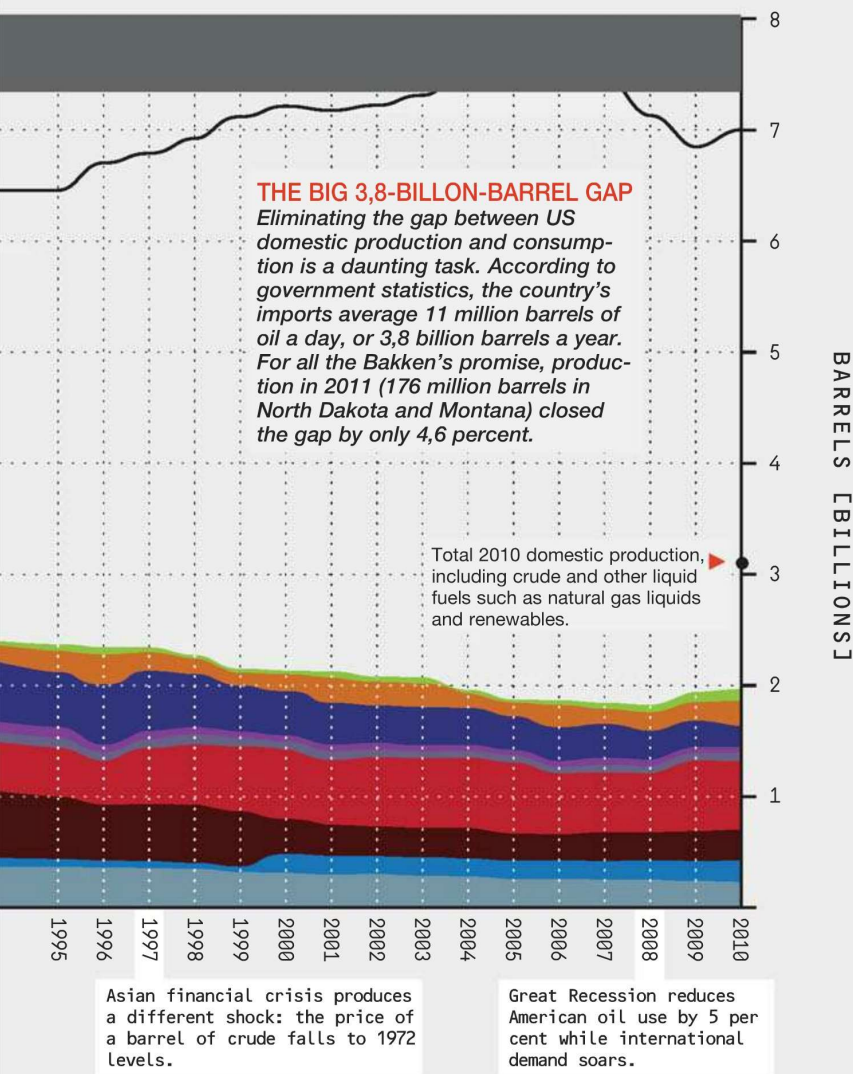
GREEN CARS: 730 MILLION B/YR

Natural gas vehicle boosters claim that 1,5 million vehicles could be sold by 2020 – but that saves only 150 million b/yr. The most optimistic projection of electric vehicles, from the University of California, Berkeley, sets a 2020 figure at 45 per cent of new car sales – up from today’s 0,0015 per cent. That

change would reduce oil use by about 365 million b/yr.

GULF OF MEXICO: 1,4 BILLION B/YR

The Citigroup report cites this amount as an achievable goal by 2020. But after the Deepwater Horizon disaster, few experts think there will be enough wells approved to hit this level of production. According to US government figures, which factor in the impact of current regulations, production in the Gulf will increase to only 0,7 billion b/yr by 2020.



my order to come up at McDonald's. Unemployment is around 1 per cent, and Williston mayor Ward Koester estimates that there are more than 3 000 local job openings. The work isn't just out on the rigs, either; the newcomers need places to eat, shop, live and blow off steam. Melissa Slapnicka, the co-owner of a strip club called Whispers, recently boasted to CNN that "my best girls would rather dance here than in Vegas because they make more money here".

Civic infrastructure, though, hasn't kept up, Koester and other local mayors say. Schools and hospitals are crowded, sewage systems overwhelmed, and police flooded by service calls. The numbers of burglaries and violent crimes are on the rise. The most acute problem is the housing shortage, despite all of the hotels and apartment complexes being built.

Jacob Brooks, managing editor of the *Williston Herald*, says that many apartment dwellers have faced annual rent increases of almost 300 per cent and that "seniors who had been living in Williston their whole lives were having no choice but to leave town". By necessity, more than a dozen temporary "man camps" have sprouted in the Williston Basin to house thousands of workers. I spend a night in one of them and experience an ambience that is midway between a motel and a minimum security prison.

Some locals are also concerned about fracking's environmental

impacts, especially those related to water. In the Williston Basin, where typically less than 40 cm of rain fall per year, fracking a single well requires around 13 million litres of water, enough to supply a town of 1 000 people for close to six weeks.

Lynn Helms, the head of the state's oil and gas division, said last year that North Dakota was "pretty much maxing out our available water resources". Much of the water for fracking is delivered by truck. Helms and other state officials are hoping to obtain permission from the Army Corps of Engineers to draw water from Lake Sakakawea, which lies just south of Williston.

The idea that subterranean fracking could directly pollute the state's aquifer horrifies environmentalists, though this concern stems in part from a faulty understanding of the process. The Williston Basin's aquifer is 600 metres deep and is shielded from contamination by 2,5 kilometres of rock that separates it from the Bakken Formation far below. "We are nowhere near our water zones when we're fracking our wells," Neset says.

Oil, however, does have to pass through the aquifer when it's being pumped to the surface. To prevent any oil from accidentally seeping out, the well bore has double layers of steel and cement casings, which in theory are perfectly secure – as long as workers didn't make any mistakes during installation. (A casing failure was one of the primary causes of the *Deepwater Horizon* disaster in 2010.) "Any time you have humans and machines working together, you're going to have an error somewhere," says Donny Nelson, a Williston Basin cattle rancher and member of the Dakota Resource Council.

Perhaps the most significant environmental concern about fracking is not what happens during the process, but afterward. The millions of litres of chemical-laced fracking solution from each well are deep-injected into the ground after use, removing them from the water cycle, but also raising the spill risk if the transfer is mishandled. The drill cuttings, meanwhile, are dumped into on-site pits, which have the potential to leak.

The Environmental Protection Agency is investigating possible groundwater contamination from hydraulic fracturing operations further to the west in Pavillion, Wyoming. A draft report released in December 2011 stated that "detection of high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons... indicates that pits are a source of shallow groundwater contamination".

The American Petroleum Institute's Chilli Cook-Off is a big event on the Williston social calendar. Hundreds of attendees pack a hotel atrium and crowd up to the well-stocked bars. A country band atop a high stage cranks out Gretchen Wilson's "Redneck Woman", while servers at booths from Halliburton, National Oilwell Varco, and Calfrac dish up bowls of fiery chilli. Even here, where the industry has come to toast itself, nobody pretends that the boom is impact-free. But people are making money, that finest of mood-altering drugs, and many folks believe they're making history as well.

Sitting at one of the long tables in the centre of the room, Larene Grondahl says that she is profiting from the rush. "I'm an oil baroness," she jokes, explaining that she inherited a one-fifty-second share of the mineral rights for a well and receives a few thousand bucks a year in oil company royalties. Some people who wholly own well rights receive far more. "There's farmers up here getting hundreds of thousands of dollars every time they get a cheque," Dennis, Larene's husband, says.

The Bakken isn't the only unconventional play that's boosting incomes and, potentially, oil supplies. Amy Myers Jaffe, director of Rice University's Baker Institute Energy Forum, estimates that the Americas have 6,4 trillion-plus barrels of unconventional resources, from the oil shales of Colorado and Utah to the oil sands of Canada and Venezuela. By comparison, conventional Middle Eastern and North African fields hold about 1,2 trillion barrels. She predicts that "by the 2020s, the capital of energy will likely have shifted back to the Western Hemisphere".

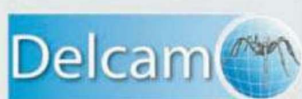
Sceptics, meanwhile, point to those high extraction costs and low recovery rates in places such as the Bakken. North Dakota wells are

indeed gushing, but haven't made up for the long-term production declines from oil states such as Texas and Alaska. US domestic oil production peaked in 1970 at 3,5 billion barrels a year, according to the Energy Information Administration; the output today is only 2 billion barrels. Paul Horsnell and Amrita Sen, two energy sector analysts for Barclays Capital, recently cautioned investors to be wary of euphoria and excess optimism when it comes to domestic supply. "Does shale oil help the US reduce its dependence on foreign oil? Yes, it does," the analysts wrote. "But does it remake the US into the next Saudi Arabia? No, at least not yet."

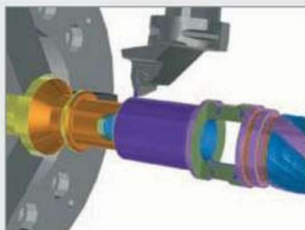
But people at the Chilli Cook-Off know just exactly where they stand on oil in the Americas: they're betting long. Statoil's Rankin finds me in the crowd and invites me up to a small party in a hotel room that overlooks the atrium. There's chilli in a Crock-Pot and Miller Lite on ice in the bathtub. Rankin introduces me to his wife. They're both from elsewhere but are having a house built on 8 hectares of land east of Williston.

The rock beneath North Dakota has as many as 30 oil-bearing zones, of which the Bakken is just one, and Rankin is betting he'll be working here for a while. "Today we're targeting the Bakken; five years from now it's the Tyler, Lodgepole, Birdbear," Rankin says, naming stratigraphic formations. "We're just getting started."

PM



Advanced
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9am - 5pm

Hall 9 Stand F20

NEW



BECAUSE DADS NEED EXTRA CARE TOO...

VICTOR MATFIELD WITH HIS
DAUGHTER, JAMIE.



[**SKIN CARE BUILT IN**]



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ULTIMATE LAPTOP DESK

We hot-rodged an ordinary desk into a superlative laptop (and gaming) station.

> BY GLENN DERENE AND ANTHONY VERDUCCI

We took a slim, lightweight Dell XPS 13 Ultrabook and modified a desk with extra components to fatten up its functionality. Here's what we added.

Cooling stand +

PlayStation 3 +

Wireless keyboard +

3D screen +

Drawing tablet +

Speaker system +

Optical drive +

Charging dock +

iPad mount



PM in-house geek Anthony Verducci routes cables under our modified desk using adhesive cord clips.

Modern laptops are exercises in restraint. The trend toward super-light-weight, razor-thin ultrabooks has forced computer makers to jettison extravagances such as optical drives, large-capacity hard drives, extra ports, big screens and multi-memory-card readers. Most of that stuff just weighed us down when we took our laptops on the road. But the thing is, when you sit at your desk, you sort of want it all back. Optical discs may be a thing of the past, but we've got plenty of such things of the past sitting in our offices. Cloud storage for your files is nice, but a 2-terabyte drive on

your desktop is even nicer. And a laptop with two USB ports is about four short of acceptable.

So we decided to make the best of both worlds. We took a Dell XPS 13, one of the sleekest, sexiest ultrabooks on the market, and designed a docking station that incorporated everything the computer was lacking, and then some. The idea was to take a sturdy, generic desk from a local home supplies store, then screw and strap a bunch of accessories on to it – a perfect marriage of home electronics and retail convenience.

Being shameless PM nerds, we insisted

on a few eccentricities that, frankly, made the project a lot harder. For instance, our 61 cm Sony PlayStation 3D display didn't have standard VESA mounting points to mate to our swing-arm Ergotron desk mount, so we drilled a few holes into a steel plate and fashioned our own adapter bracket. That allowed us to hide a PS3 under the desk and use the monitor for computing and 3D gaming. Why, you ask? Well, why not? If the Dell ultrabook demonstrates the elegance of understatement, the desk underneath it is our tribute to the awesomeness of overkill.

MOD YOUR DESK

That "finished" piece of furniture you bought is a few holes, wires, ports and outlets short of its cyborg ideal. Charge up your power tools.



1



2

1 START WITH THE BORING STUFF

Position your equipment where you want it on the desk. Group the gear around one or two spots where you can route all of your wiring, then mark those spots for drilling. Clear off the gadgets and tape the desk surface to prevent damage. A 25 mm holesaw will make an opening for five or six wires.

2 FREE YOUR MONITOR

This PlayStation 3D monitor was not made to be mounted, but we did it anyway, using a few semi-trustworthy anchor points and an Ergotron LX desk mount (about R1 400 from Amazon, or similar). A monitor on a swing arm is worth the trouble – it frees up desk space and lets you place your screen virtually anywhere.



4



3

3 EMBRACE THE UNDERBELLY

If you're trying to accommodate lots of stuff, try this tactic: we flipped our desk over and attached components (PS3, optical drive, extra USB ports) to the underside using duct tape. When possible, we also used the desk's existing fasteners.

4 DON'T SKIMP ON OUTLETS

We needed a power strip, but we didn't want to see it. And don't you just hate it when surge protectors get crowded by large adapters? This seriously long multi-plug thingy fixed both problems with a whole bunch of amply spaced outlets and mounting brackets that let you hide it under the desk.

PM

Computing on the go

Stay connected, wherever you go

As we predicted, notebook and tablet manufacturers around the world have upped their game to the point where they are now presenting us a serious dilemma: should we commit our cash now and acquire a very nice piece of mobile computing kit, or should we wait a couple of months for the introduction of something faster, sharper and possibly better-looking? Then there's the choice of operating system: do we succumb to Apple's siren call, devour Android's tasty Ice Cream Sandwich, or take our chances with Windows? Then there's the CPU thing: do we opt for Apple's proven gem, insist on nVidia's Tegra (count those cores!), or hold out for Qualcomm's formidably good Snapdragon? While we're brooding about the plethora of choices, here are a few items of interest...

Super-mobile?

Why would we include a mobile phone in a feature on mobile computing? Let's think about this for a moment: it comes with a sharp screen, formidable storage capacity, a powerful CPU, and the ability to perform functions that would put many a notebook to shame. Oh, and it goes wherever we go. Next question?



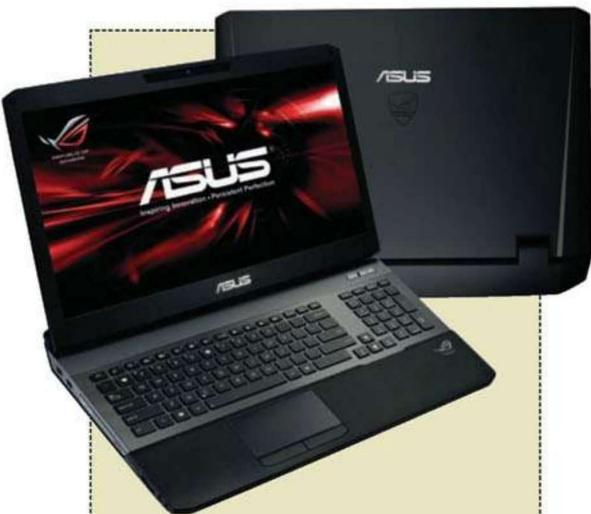
HTC One X

It was the star of the Mobile World Congress in Barcelona earlier this year, and now it's here to beguile us, impress us, and – if HTC has its way – lure us away from *that* phone. The HTC One X has been hailed as a “superphone”, and it's not hard to see why. First up: a quadcore 1,5 GHz nVidia Tegra CPU for amazing performance and serious gaming capability. Next, the phone comes with Android's delicious Ice Cream Sandwich (naturally) plus masses of storage – 32 GB of it onboard plus a further 25 GB of free Dropbox cloud space.

With a 4,7-inch Gorilla Glass LCD2 screen and needle-sharp 720p resolution, this baby offers an excellent video viewing experience and, thanks to Beats Audio, the sound is pretty damn good, too. There are two cameras – a 1,3 MP front-

facing and an 8 MP rear-facing (it captures video at 1 080p). Cool features include dual shutters, a 5 fps burst function, and the ability to grab high-def still images from movies.

A member of PM's editorial team has owned an HTC Desire HD for the past 18 months, during which time he's done a fair bit of showing off. Now, having spent a few days with HTC's One X, he's suddenly gone quiet. Likely reason: the discovery that he's not yet due for an upgrade...



Hardcore gaming to go

Decimating your virtual enemies is a cinch when you have hardcore ordinance such as Asus' latest gaming notebook, the ROG G75VW, at your disposal. Featuring Intel's 3rd-generation Core i7 processors, the latest nVidia GeForce GTX 660M/670M GPUs with up to 3 GB of GDDR5 VRAM, up to 16 GB of DDR3 DRAM and support for dual hard drives in RAID 0/1 – this baby redefines what can be accomplished with a gaming notebook.

However, abundant performance without adequate cooling is pointless. That's why it comes with an intelligent dual thermal system – featuring one fan for the CPU and another for the GPU, complete with detachable fan filters to further increase efficiency – to keep heat away from components and a unique rear-venting design.

Active shutter glasses, combined with nVidia 3D LightBoost technology, are said to deliver an unrivalled experience when viewing 3D games and movies. This visual fest is enhanced by the addition of large speakers and a built-in subwoofer to deliver powerful sound and richer bass.

The outer shell combines a sculpted profile with gamer-centric features. Continuing in that vein, the one-piece backlit keyboard with isolated arrow keys and 'W' key indicator ensure you'll never miss a frag (gaming slang for kill). The slightly inclined body provides comfort during prolonged gaming sessions. Finally, the anti-glare matte 44 cm display with its wide viewing angle reduces eyestrain during those late night frag-fests. Price: about R28 000. Visit www.asus.com

No batteries required

Wireless keyboards are uber-convenient, until you have to recharge or replace the batteries. That said, Logitech's Wireless Solar Keyboard K760 (for Mac, iPad and iPhone) was designed to never run out of juice. Powered by any light source via its solar panel – be it that huge nuclear reactor in the sky or humble lamplight – once fully charged, it's said to work for at least three months, even in total darkness.

Its easy-switching Bluetooth connection (range up to 10 m) makes typing on your Mac, and switching to type on your iPad or iPhone, a no-nonsense affair. It features a familiar Apple layout with all the keys you'd expect, such as Command, Brightness, Eject and more. Plus, its slim, minimalist design means it can go wherever you go. As it's only expected to land in the country later on in the year, no price has been determined yet. Contact distributor Pinnacle Africa on 011-265 3000 or visit www.logitech.co.za



Tablet or notebook – you choose

Asus didn't name its new tablet the Transformer Pad for nothing. That's because, once connected to its optional mobile dock (costing about R1 500), it instantaneously morphs into a fully fledged notebook – giving you the convenience of a full QWERTY keyboard, multi-touch touchpad and USB/SD card ports.

The tablet, with its slim 9,9 mm profile and 25 cm WXGA LED Backlit display, weighs 635 grams – so carting it around all day shouldn't be a hassle. Featuring the latest version of Google's mobile operating system, it runs Android 4.0 (Ice Cream Sandwich) for easy multitasking, rich notifications, customisable home screens and more. The preinstalled SuperNote application lets you take, draw or record notes. Polaris Office gives you the ability to read or create Word, Excel and Power-

Point files. You also get 32 GB of internal memory, a microSD slot and 8 GB of free on Asus WebStorage for life.

Camera complement consists of a front 1,2 MP unit to facilitate video conferencing and a rear 8 MP unit with a large f2.2 aperture, 5-element lens, back-illuminated CMOS sensor and touch-to-focus functionality. The main camera can record Full HD 1080p video.

Other features include a wide 178-degree viewable display, up to 10 hours of runtime (extended to 15 hours when combined with the mobile dock), 802.11 b/g/n wireless connectivity and Bluetooth 3.0. Price: about R5 000 for the TF300T (basic model), and about R6 000 for the TF300G (with 3G module). Visit www.asus.com



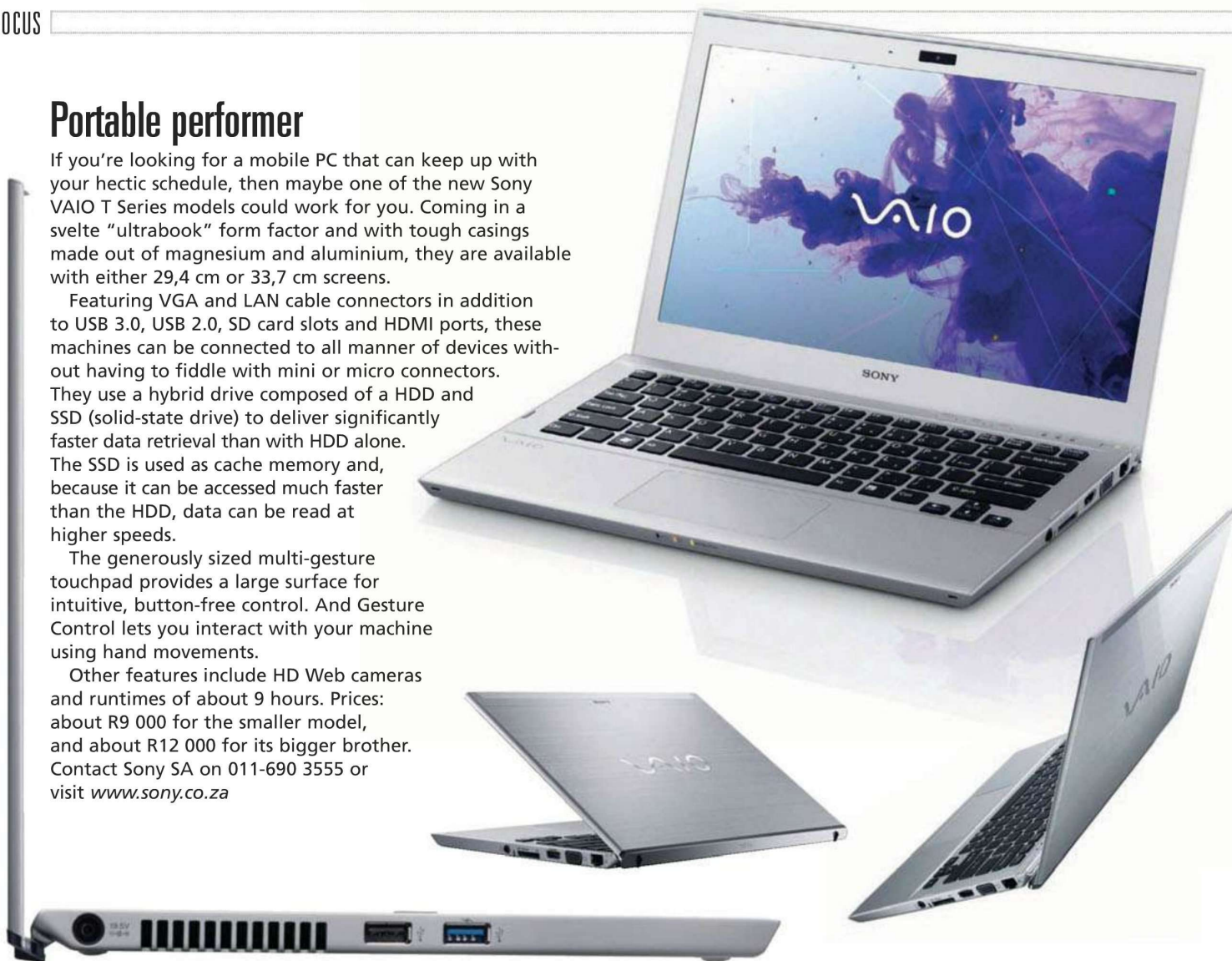
Portable performer

If you're looking for a mobile PC that can keep up with your hectic schedule, then maybe one of the new Sony VAIO T Series models could work for you. Coming in a svelte "ultrabook" form factor and with tough casings made out of magnesium and aluminium, they are available with either 29,4 cm or 33,7 cm screens.

Featuring VGA and LAN cable connectors in addition to USB 3.0, USB 2.0, SD card slots and HDMI ports, these machines can be connected to all manner of devices without having to fiddle with mini or micro connectors. They use a hybrid drive composed of a HDD and SSD (solid-state drive) to deliver significantly faster data retrieval than with HDD alone. The SSD is used as cache memory and, because it can be accessed much faster than the HDD, data can be read at higher speeds.

The generously sized multi-gesture touchpad provides a large surface for intuitive, button-free control. And Gesture Control lets you interact with your machine using hand movements.

Other features include HD Web cameras and runtimes of about 9 hours. Prices: about R9 000 for the smaller model, and about R12 000 for its bigger brother. Contact Sony SA on 011-690 3555 or visit www.sony.co.za



Stay connected

The state of your Internet connection can make the difference between clinching that big deal, or not. Fortunately, the VKOM 351W 3G router was specifically designed to keep you and your team up and running – regardless of little disasters such as your office line crashing.

This fully portable device serves as a hub for a 3G USB modem, turning a single connection into a Wi-Fi hotspot that allows up to 32 devices to connect wirelessly. It's also easy to set up, requires no drivers (so it works on all operating systems), and supports both static and dynamic IP options with speeds of up to 150 Mbps.

Your IP address is automatically supplied using a DHCP server. Security is included, with WEP, WPA and a built-in firewall. It also offers both battery and mains power options, as well as an optional car charger for those always on the move. Price: about R600. Contact distributor Nology on 012-657 1317 or visit www.nology.co.za



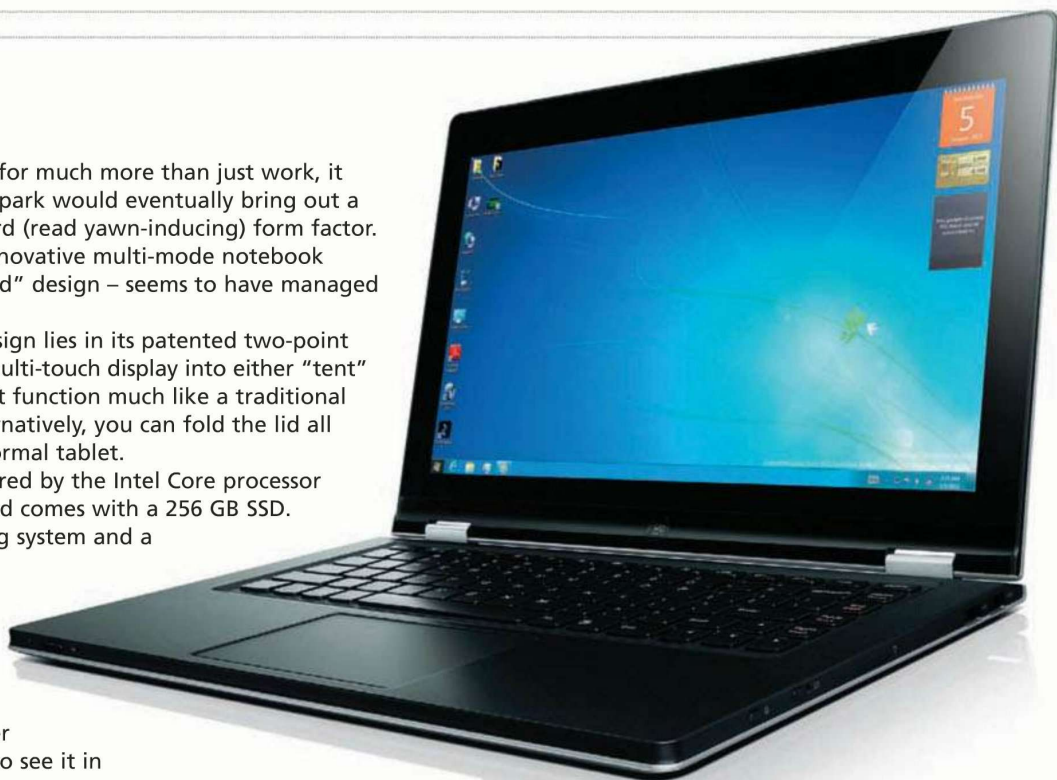
Bend me, shape me

Seeing that we use our mobile PCs for much more than just work, it stands to reason that some bright spark would eventually bring out a machine that redefined the standard (read yawn-inducing) form factor. Lenovo's new IdeaPad Yoga – an innovative multi-mode notebook boasting a 360-degree “flip and fold” design – seems to have managed just that.

The secret behind its versatile design lies in its patented two-point hinge. You can fold the 34 cm HD multi-touch display into either “tent” or “easel” configurations, making it function much like a traditional tablet propped up by a stand. Alternatively, you can fold the lid all the way around and use it like a normal tablet.

On the computing side, it's powered by the Intel Core processor family, features up to 8 GB RAM and comes with a 256 GB SSD. You also get a Windows 8 operating system and a runtime of about 8 hours.

For a full-sized notebook it's impressively slim at 16,9 mm, with a few nice touches such as soft rubber paint on the exterior, a leather cover on the palm rest and side buttons designed for easier access for all usage modes. Expect to see it in stores come October. Contact Lenovo on 011-514 7500 or visit www.lenovo.co.za



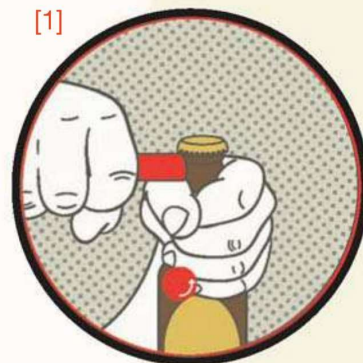
Crossing the OS divide

Techno geeks looking for a simple way to share content between their Apple devices and other platforms need to check out PhotoFast's i-Flash-Drive. This Apple-approved device features a 30-pin dock connector on one side and a standard USB plug on the other, making it compatible with all Windows, Mac and Linux operating systems. To make life even simpler, it comes with a free, downloadable application that enables you to use your iPhone/iPad touch screen to give the relevant commands for copying and saving. Oh yes, it can also be used as a normal USB drive. Price: about R1 000. Contact distributor Gammatek on 011 201 0800 or visit www.gammatek.co.za PM





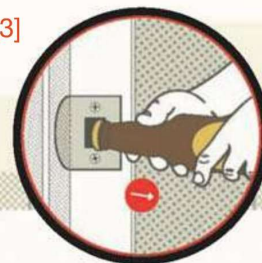
[1]



'Give me a place to stand on and I'll open any damn bottle.'

Okay, maybe Archimedes never uttered those exact words. But his principle of leverage is the basis for the classic metal bottle opener – and also works with an odd variety of objects.

[3]



Put a one-handed stranglehold on the bottleneck, and use a [1] **DISPOSABLE PLASTIC LIGHTER** (a longtime fave) or a [2] **USB DRIVE** as a lever (and a knuckle as a fulcrum) to pop the top – and learn a refreshing lesson in applied physics.

An old standby (with a high spill factor): Place the bottle top in a door's [3] **METAL STRIKE PLATE**, letting the crown catch on an inside edge; pull back on the bottle.

The squarish opening of a [4] **CAR SEATBELT LATCH** works surprisingly well. Never try this in a moving vehicle.

Position the fang-like teeth of a [5] **STAPLE REMOVER** under the crown and gently pull up, working your way around the cap until it's loose enough to pull off. This "uncrimping" can also be used with a [6] **METAL NAIL FILE** or a [7] **KEY**. Of course, your emergency beer-bottle-opening tool kit can include, you know, real tools: a [8] **FLAT-HEAD SCREWDRIVER**



20 ways to open a beer bottle

BY WOOK KIM



decrimps nicely, as do [9] **WIRE CUTTERS**, standard [10] **PLIERS** – or, better yet, those of the [11] **NEEDLE-NOSE** variety.

There is a brute-force alternative to decrimping for those lacking patience or manual dexterity. Clamp the bottle between your thighs and apply upward thrust to the cap's lip with the edge of a [12] **METAL RASP**, a [13] **BUBBLE LEVEL**, or an electronic gadget, such as an early [14] **IPOD NANO**. And if you're



comfortable with a sturdy pair of [15] **SCISSORS** buzzing in your fly zone...

A [16] **RING** can open a bottle, too. (Not your wedding band, pal – soft metals like gold easily pit and bend.) Hook your finger over the top of the bottle, making sure the ring catches on the cap, and push up (or pull down) until it dislodges. This may hurt; but on the other hand: beer.

Swing the gate of a large [17] **CARABINER**



inside and use it to gain a purchase on the bottom of the crown; with the spine hooked over the cap, firmly pull up. [18] Hook the cap's lip on the edge of a hard **COUNTERTOP** (not, God forbid, on an antique sideboard) and rap the cap with the heel of your palm. This also works on a [19] **SHARP-EDGED BOULDER**, or a [20] **BELT BUCKLE**, in which case, be careful where and how hard you strike.



HOGSHEAD

Kegs are for sissies. If you're looking to throw a bash for the ages, you should be talking hogsheads. Usually used to refer to a container or cask holding a large volume of any ole liquid, a hogshead is most often applied to measuring alcoholic beverages such as wine, cider and, um, beer. Whereas a typical keg contains 60 litres, a hogshead holds 200 litres, perfect for those occasions when you're entertaining a small city.

! PLEASE DON'T! The above methods – PM-field-tested and -approved – represent the spectrum of ways to defeat those serrated-metal impediments to sudsy succour. But there are less advisable techniques available for viewing online: grip the bottle and carefully move the crown edge toward the spinning wheel of an upended bicycle, until a spoke catches and pops off the cap. Place the cap edge on the inside of your bottom row of molars, bite down, and pull the bottle up and away. Last and least advised: hold the beer on the ground between your boots, fire up a chain saw, and close in until a single chain tooth catches the bottom of the cap. Bring a change of underwear, and make sure your estate is in order. **PM**

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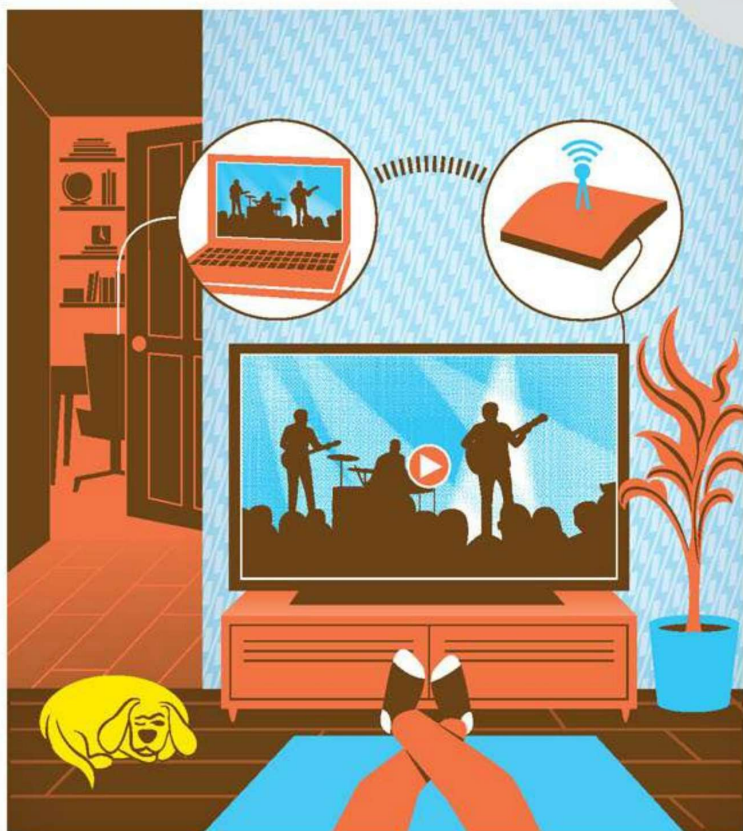
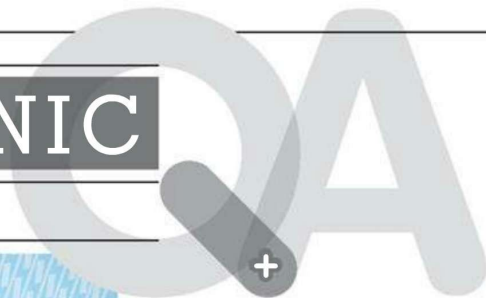
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DIGITAL CLINIC

> BY JOHN HERRMAN



Interpretation of streams

Nearly every video, song and photo I have lives on my computer. My TV is in the living room – across the house. What's the easiest way to bridge the two?

A You need three things to transfer media across your home. The first is a media source, or server, which you already have – your computer – that has all the videos, music, and photos on it. The second thing you need is a receiver of some sort that supports the Digital Living Network Alliance (DLNA) standard.

If your TV is a relatively new “smart” TV equipped with Wi-Fi, it can probably act as a media receiver; if not, you'll need to attach an external one. The Western Digital WD TV Live Streaming Media Player is a good option. It supports Online streaming (in SA, this might involve a hack.) Both the Xbox 360 and PlayStation 3 also support local media streaming, along with a full complement of Internet streaming services.

The third thing you need is a translator – that is, software to take your media and make it visible to your streaming box. Windows can stream some video types natively via a feature called Windows Media Centre, but you're far better off downloading a free app called TVersity. This will make your media visible to any DLNA device or game console and, if necessary, convert the files to a format your device can read. (For this feature to work, you'll need a fast processor

– at least a Core 2 Duo.) As a bonus, TVersity can stream to your mobile devices, as long as they're connected to your home Wi-Fi network.

Mac users using a DLNA TV or streaming box should download an app called TwonkyServer, which will immediately make your media collection visible to your streaming device. PS3 or Xbox owners will be better served by the now-free Rivet application, which will stream your content and retain your computer's folder structure.

Wireless speed is also important. Even if your router claims to transfer data at a full 54 megabits per second – the top speed of 802.11g routers, which is theoretically more than fast enough to stream an HD video – signal fluctuations can reduce that data rate drastically. You don't really notice the difference when you're surfing the Web; you do notice it when you're subjecting the connection to a steady load. File-sharing apps such as BitTorrent are a common cause of speed fluctuations, but distant router placement can cause problems, too. If your Wi-Fi video streams are getting choked, it might be time to consider upgrading to a faster 802.11n router or, better yet, rolling out some Cat 5e Ethernet cable.

UPDATE OVERLOAD

Q I love Facebook and I love my cousin, but sometimes his updates are a little... much. I don't want to unfriend him, but it's getting obnoxious.

A It's possible to mute your Facebook friends without notifying them. If you hold your mouse cursor over your cousin's picture in a status update, a miniprofile should appear with a drop-down menu button. Select Settings from that menu and then you can customise how many updates you'll receive from him. You'll still be able to check his profile whenever you want – say, before the next family reunion – but his updates won't clutter your main feed.

PM

DON'T BE AN IDIOT

NEVER SOLDER HEADPHONE CABLES

WITH ENOUGH flux, patience and time, any two wires can be soldered together. But my experience on a recent Saturday exposed the folly of trying to experiment with modern earbud cables. I wanted to join my high-quality JH Audio in-ear headphones with the highly useful inline controller found on the cord of iPhone earbuds. So I snipped the earbuds off Apple's cable and stripped back the sheath, which revealed stranded wires of such gossamer thinness that a stray breath could move them out of position. Stripping the JH

Audio cables released a similar spider-web of thin wire. What was intended to be a 5-minute project turned into a 45-minute mess of frayed wire, melted insulation, shaky hands and sloppy soldering. Now I have nothing to show for my work except two destroyed sets of earbuds. Bummer.

– GLENN DERENE



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The all-new Ford Focus combines dynamic exterior design with a driver-focused interior, featuring a cockpit-style layout and superior craftsmanship. With its striking front end, sleek profile and athletic stance, this Focus enjoys sporty and contemporary styling while maintaining the comfort and practicality characteristic of the Focus brand.

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Mazda CX-5

REDEFINE THE FUTURE

Breakthrough innovations in the new Mazda CX-5 reduce fuel consumption and emissions while maximising performance and driver involvement

SUSTAINABILITY VS THE GRIN FACTOR

It's a delicate balance. A set of compromises. Or, just occasionally, a win-win situation: the all-new CX-5 encapsulates how Mazda's endless striving for efficiency has become an obsession – matched only by an equally fierce commitment to putting a smile on the driver's face.

Breakthrough innovations underpin the Mazda CX-5, promising to reduce fuel consumption and emissions, yet at the same time to maximise performance and provide a more enjoyable driving experience. It's the first production Mazda fully equipped with **SKYACTIV** technology, which represents a complete rethink of engine, transmission and chassis design.

But the CX-5 is also a design pioneer in a more visible sense: it pioneers Mazda's bold new theme, "KODO – Soul of Motion", inspired by the cheetah's powerful athleticism. Showcased at the 2011 Geneva Show by the Minagi concept car, this theme will guide all new Mazdas going forward.

POWERTRAIN: UNDER PRESSURE

The new-generation high-efficiency **SKYACTIV-G** 2.0 direct-injection petrol engine provides abundant low-end torque for acceleration that precisely matches driver intentions, with outstanding fuel efficiency. With an unprecedented, industry-leading 13,0:1 compression ratio and

considerably lower internal friction losses than conventional equivalents, the **SKYACTIV-G**, delivers more torque, better fuel economy and lower emissions than the competition.

A newly designed 4-2-1 exhaust system and special pistons resolve the challenges associated with high compression. The 4-2-1 system effectively lengthens the exhaust manifold to reduce build-up of high-temperature residual gas in the combustion chamber, thereby helping to suppress knocking.

The bald facts: output of 114 kW at 6 000 r/min and 200 N.m at 4 000 r/min.

Designing the **SKYACTIV-DRIVE** six-speed automatic transmission was easy... sort of. Selectively combining the advantages of all modern transmissions has resulted in a design with a sophisticated balance between the direct feel of a manual transmission, smooth shifting and outstanding fuel economy. In addition to enhancing fuel economy through a near full-range lock-up, **SKYACTIV-DRIVE** offers greatly im-

proved transmission control and co-ordination with the engine.

For those who hanker after the kind of sporty, plugged-in shift exemplified by Mazda's MX-5 sports car, you'll be pleased to hear that the feel – and spirit – are duplicated in the **SKYACTIV-MT** six-speed manual transmission. Its lightweight, compact design contributes to fuel efficiency through reduced mechanical friction and improved space efficiency.

It's hardly surprising that the **SKYACTIV-G** 2.0 is rated at 6,9 litres/100 km when mated with the automatic transmission or 6,8 litres/100 km with the manual.

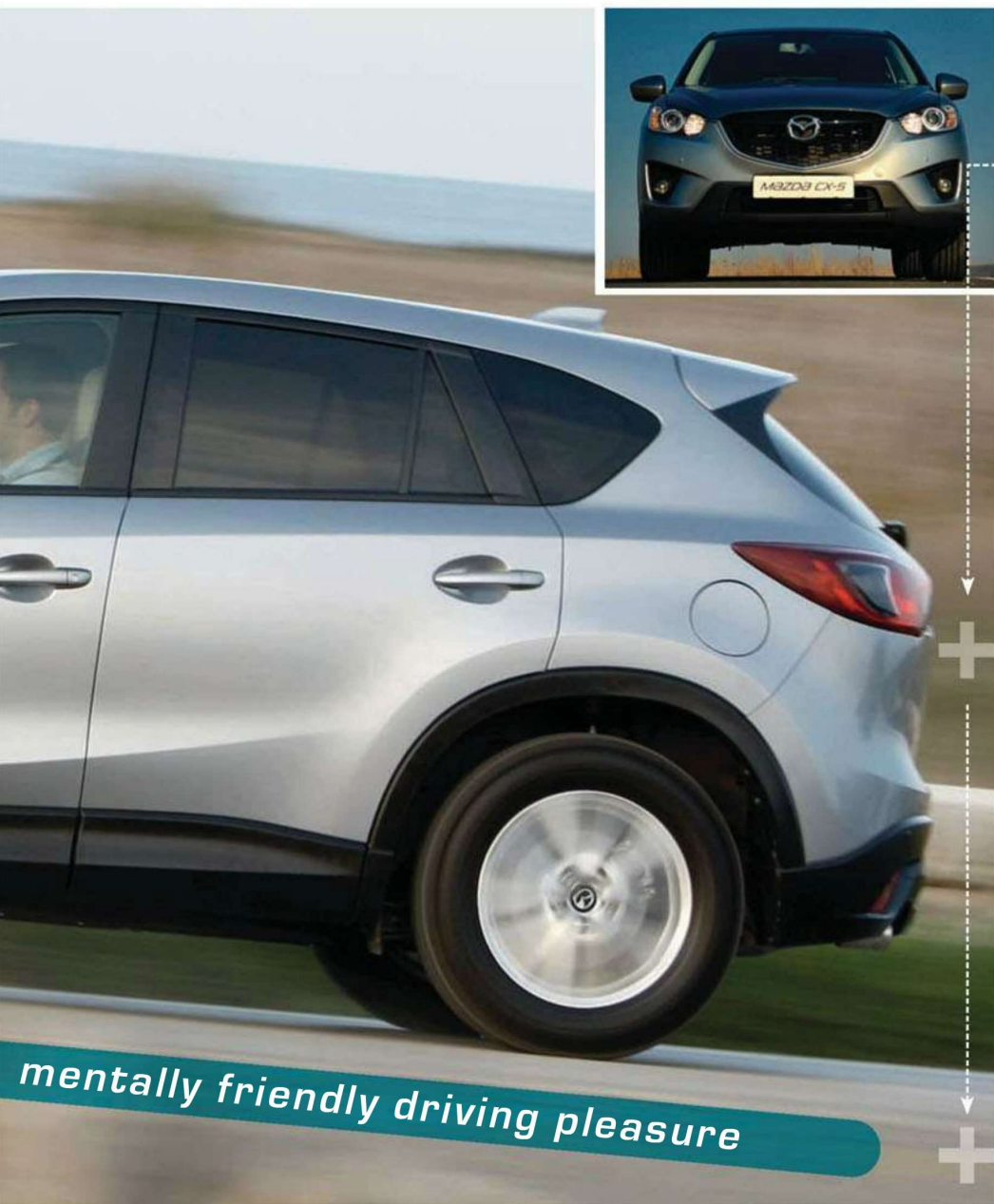
DESIGN: SUV FOR SOPHISTICATES

From the forward-tilted nose to the sculpted flanks and taut rear, the CX-5 conveys a powerful sense of motion and coiled muscles tensed for action. "We looked at videos of cheetahs; their agile footwork and how they use their whole body as a spring to accelerate rapidly



Mazda CX-5 + SKYACTIV = environ





SPECIFICATIONS:

CX-5 2.0 ACTIVE

- 6-speed manual transmission
- Height and reach adjustable steering wheel
- 17" Steel wheels
- Body colour bumpers
- Body colour door handles
- Body colour power fold mirrors
- 4-Speaker sound system
- Rear spoiler
- Roof rails
- Manual air conditioning
- Auxiliary power point

CX-5 2.0 DYNAMIC AT (features over and above those already found on the Active)

- 17" Alloy wheels
- Alarm
- 6-speed automatic transmission
- Bluetooth cellphone interface
- Cruise control
- Front fog lights
- Leather gear knob
- Leather steering wheel
- 6-speaker sound system
- Karakuri tonneau cover
- Vanity mirror illumination

CX-5 2.0 INDIVIDUAL AT (features over and above those already found on the Dynamic)

- 19" Alloy wheels
- 9-speaker Bose® sound system
- Dual control automatic air-conditioning
- Adaptive front light system (AFLS)
- Auto headlamp levelling
- Auto headlamp on/off
- Auto interior rear-view mirror
- Back-up monitor
- Bi-Xenon headlamps
- Driver and passenger heated leather seats
- Driver's seat lumbar support
- Parking sensors
- Rain sensing wipers
- Power seat adjustment
- Smart entry system
- Sunroof

and change direction instantly. They emanate great energy throughout their entire body. Inspired by their efficient yet beautiful movement, we aimed to push SUV appearance to new levels with the KODO design language," explains chief designer Masashi Nakayama.

The sophisticated exterior design expresses SUV sturdiness and functionality, while boldly projecting an elegant sense of motion. Appropriately, the CX-5 is the first production model to feature signature wings – a line signifying wings in flight runs across the bottom of the grille before extending outwards to the headlamps. It forms the centre of a next-generation family face that refines the characteristic Mazda five-point grille.

To go with the form, there's also plenty of function: to achieve a smooth airflow under the vehicle and prevent eddies forming behind it, a new underfloor design directs exiting air upwards. The resultant reduction in underfloor air resistance helps the CX-5 achieve a drag

coefficient of just 0,33.

And of course the CX-5 is an SUV, so the driver has a commanding viewpoint. But it's also a Mazda, so the controls and pedals are optimally located. A deep meter hood draws the driver into the instrument panel, much like a sports car would. Dial illumination is changed from Mazda's current amber-red to white, and the needles are given a metallic appearance for a classic sports car look.

Similarly, areas most often seen and touched – the instrument panel and door trim – are finished in premium, soft-touch materials. Heavily used areas such as the steering wheel spokes and inner door handles have a satin chrome finish for an even higher feel of quality.

And although sporty, the CX-5 is also practical. It can easily accommodate five people, and all of their luggage, in comfort. For, despite its compact exterior, the CX-5 is spacious on the inside, with a mirror-to-mirror width of 2 165 mm and a wheelbase of 2 700 mm.

DYNAMICS: ACTING IN HARMONY

The CX-5's driving dynamics were developed with a dual perspective: vehicle behaviour and driver feel. Mazda engineers worked to maximise ease of use in every interface between car and driver – including steering and pedals – as well as enhancing the driver's field of view. A non-negotiable was the elimination of unwanted vehicle behaviour that required corrective input from the driver. Achieving a high level of predictable, responsive handling involved addressing three specific areas: predictability, synchronisation and harmonisation.

Predictability. Ensuring that the vehicle changes its behaviour in response to the driver's inputs and intentions. This allows the driver to make instantaneous decisions on what input is required next and how the car will respond to that input.

Synchronisation. Driving involves consecutive operations that ideally should involve a smooth, swift transition from one operation to the next. In effect, this means realising vehicle response true to the driver's intentions from the first action, with no need for corrective inputs. Vehicle feedback is crucial: depending on the quality of feedback, the driver can quickly sense whether the vehicle is moving as intended, or if there is a need for corrective input. There has been a focus on dramatically improving the quality of this feedback.

Harmonisation. When driving, a combination of operations are required to meet the driver's intentions, with the driver compensating if circumstances demand it. Engineers aimed to ensure that the driver experiences these multiple operations – driving, turning and stopping – as harmonised events.

Putting these concepts into practice entailed a comprehensive strategy based on the lightweight yet rigid **SKYACTIV-BODY**. Its framework is optimised for handling stability, low noise, vibration and harshness (NVH) and superior collision safety performance. High-tensile steel makes up 61 per cent of the frame and includes the world's highest-grade 1 800 MPa material.

Then, newly developed MacPherson strut suspension at the front and a multi-link layout at the rear help the **SKYACTIV-CHASSIS** deliver Mazda's trademark *Jinba Ittai* feel – the concept of being at one with the car. Suspension link geometry and bush characteristics are optimised to assure light, linear steering responses at low- to mid-speeds, along with outstanding high-speed stability. The rear dampers feature a forward-tilting layout for greater ride comfort even on rough surfaces.

Closer to the driver, a newly developed electric power assist system offers precise control that matches vehicle speed. At low- to mid-speeds it provides natural feedback and a linear feeling from small to large angle inputs. At high speeds it gives firm, confidence-inspiring feedback. The brakes provide precise, assured, easily controlled braking at all speeds.

The attention to detail extends to the treatment of NVH to ensure the driver hears only necessary feedback, while intrusive noises are actively reduced. Noise was initially separated into road noise and engine noise. Then unpleasant low-, mid- and high-frequency noises in each were individually identified and reduced to achieve a quieter cabin environment.

COMFORT AND CONVENIENCE: IT'S ABOUT YOU

If it seems unusually easy to enter and exit the CX-5, that's because of all the hard work that went into making it *seem* easy, including motion-capture photography and advanced computer simulations. Unlike conventional SUVs, the door completely covers the sill, so the sill is narrower and kept clean. Benefit 1: it's easier to step over the sill; Benefit 2: it prevents clothing from being soiled during entry and exit.

Comfort, convenience and flexibility were key guidelines in creating the CX-5's functional yet welcoming cabin. The result is a comfortable, human-centred area with notably efficient use of space and intelligent functionality with ergonomically optimised controls and instruments delivering information at a glance.

The 2 700 mm wheelbase is one of the longest in its class. It allows both sleek styling and a roomy, comfortable cabin. Head-, shoulder- and legroom are all at or near the top of the class, allowing four adults to easily change their posture and relax in comfort, with an upright sitting posture that minimises stress and relieves fatigue on long journeys. Rear passengers enjoy class-leading legroom of 997 mm and knee clearance of 66 mm.



Ergonomically optimised controls are matched with high-tech displays.



**SKYACTIV
TECHNOLOGY**



The world's first remote control fold-down 4:2:4 rear seats use levers located in the top trim of the luggage compartment to allow individual folding of the left, centre and right seatbacks. Even with two child seats fitted, the centre seatback can be folded to enable the "centre-through mode" for loading long items. All three seatbacks can be folded to create a large, completely flat luggage area. When the rear seats are in use, the luggage area provides 403 litres (VDA) of usable space – big enough space for four golf bags – thanks to the elimination of protrusions and dead space. With the seats folded down, the 1 560 litres of space can



SKYACTIV-DRIVE 6-speed automatic balances direct feel of a manual with smooth shifts and economy of an auto.



SAFETY: COMPOSED AND COCOONED

The new-generation **SKYACTIV-BODY** combines light weight and high rigidity with excellent collision safety performance. Reducing vehicle weight does not simply boost fuel economy; it complements the engine's performance potential, and improves the vehicle's core performance attributes when driving, turning and stopping.

Impact absorption was a central focus. Overall, the multi-load path structure and a front end with cross-shaped cross-section increases crash energy absorption, further improving safety performance in front, side and rear-end collisions. A new design of front suspension structure ensures that the engine breaks away from the suspension cross members during a crash. This maximises energy absorption by creating a larger crumple zone.

Cost-effectiveness has been built in, too: Mazda has created a novel way of ensuring that front fender-benders up to 15 km/h are absorbed by easily replaceable bolt-on parts.

Clever redesign of the seats further cocoons the occupants. In the new lightweight front seats, the side frames eliminate contact with the occupant's ribcage and incorporate an anti-whiplash design that reduces the movement and rotation of the head and torso during a rear impact collision, while at the same time decreasing the load on the headrest and seatback. Back seats have an internal anti-submarine mechanism, which restrains the lower body during an accident. The rear seatback frames, mounts and hinges are reinforced to better protect rear passengers from luggage and other boot cargo. ISOFIX attachments as well as top-tether anchors are standard.

Front, side and curtain airbags are standard on all CX-5 models. Front seatbelts have pretensioners as well as load limiters, which mitigate the impact on the chest. The steering column, with its tilt and telescopic functionality for maximum comfort, helps prevent injury, too, shifting forward during an accident to absorb the driver's momentum.

The body cowl and instrument panel are also less rigid to soften the blow should a pedestrian's head hit the windscreen. Finally, the front bumper is equipped with shock-absorbing material to reduce leg injury and a rigid area at the bottom to help prevent the legs from going underneath the vehicle.

For those times when the driver is in need of a little assistance, Mazda provides a comprehensive suite of driver aids as standard across the range. In addition to Dynamic Stability Control (DSC) incorporating Traction Control (TCS), there are ABS and Electronic Brake-force Distribution (EBD) to optimise brake force according to vehicle load; Emergency Brake Assist (EBA) boosts emergency stopping power. Speaking of emergencies, Emergency Stop Signal (ESS) automatically flashes the hazard lights under sudden braking to warn the following driver.

Hill Launch Assist (HLA), a standard feature on all models, helps ensure smooth starts on uphill gradients of 2 degrees or more by controlling brake pressure to prevent the vehicle from rolling backwards. The acceleration sensor in the CX-5 has an integrated auto-learning function to better adapt to an individual's driving habits. And, the Individual specification features Bi-Xenon headlights with Adaptive Front-lighting System (AFS) that swivels the headlights up to 15 degrees in the direction that is being steered.

ENVIRONMENT: PUSHING BOUNDARIES

For the foreseeable future, we will depend on fossil fuels and our cars will be powered by internal combustion engines. That's convinced Mazda to continue towards its goal of raising the average fuel economy of its vehicles worldwide by 30 per cent by 2015, compared with 2008. The plan entails comprehensive re-invention of core technologies – engines, transmissions, body and chassis – and progressively combining these with electric devices for fuel-efficiency.

SKYACTIV feeds into this strategy and is integral to Mazda's long-term vision for technology development, Sustainable Zoom-Zoom.

Mazda's Zoom-Zoom credo is disarmingly simple: it builds cars that "look inviting to drive, are fun to drive, and make you want to drive them again". Applying this to the CX-5 has created a stylish, refined yet rugged SUV that is equally at home pounding the road less travelled or cruising the urban jungle. □

accommodate two mountain bikes with front wheels removed.

The cleverly thought-out tonneau cover, a revised version of Mazda's acclaimed karakuri design, opens and closes with the liftgate.

The Bose Premium Audio System, standard on the Individual, was jointly developed by Mazda and Bose for both sound quality and lightweight energy-efficiency. The high-performance digital amp weighs in at just 0,7 kg. AudioPilot 2 and other technologies enhance the ease of listening while driving, and Centerpoint surround sound technology delivers supremely natural sonic imaging.

INFINITI EMERG-E

SPLIT-PERSONALITY SUPERCAR

Nissan's Infiniti premium brand showed off an advanced mid-engined concept car at the Geneva Show, sending a shot across the bows of the forthcoming NSX from Honda and signalling the brand's supercar intentions.

The Emerg-E is about more than just straightline speed – although it can hit 100 km/h in 4 seconds. Built on a Lotus Evora chassis, it has a hybrid range-extender AWD powertrain.

It's the company's first midships design and the first Infiniti developed in Europe. As part of the UK Government's Technology Strategy Board consortium, whose aim is to fast-track low carbon vehicles, Nissan discovered that fellow consortium members Lotus Engineering were developing a range-extender electric sports car, leading logically to the idea of collaborating. A key feature of the Emerg-E is that it contains a blend of technologies and solutions that have not previously been tried – as required by the consortium.

With twin 150 kW electric motors driving the rear wheels via an Xtrac transmission, the Emerg-E is capable of supercar performance, but when necessary it can turn into the mild-mannered Clark Kent of high performance cars by providing zero-emission urban transport over a 50-km range. Using the range-extender petrol engine in concert with the car's twin electric motors, produces a CO₂ output of only 55g/km.

The significant components of the powertrain are a pair of electric motors, a lithium-ion battery pack, four inverters, a three-cylinder range-extending internal combustion engine and a petrol tank.

Four inverters control the motors and their energy regeneration role under braking, the recovered power directed to a lithium-ion battery mounted behind the seats. The battery can be recharged from a mains power supply (domestic and fast-charge).



EMERG-E SPECIFICATION

POWERTRAIN

Electric motor

Synchronous, twin rotor motors, one per rear wheel, EVO electric synchronous DC brushless drive
150 kW per motor (300 kW total for vehicle) available for 30 s or less. Flat distribution of power circa 3 000 r/min upwards
1 000 N.m

Power

Torque

Range extender engine

Lotus 3-cylinder, 1,2-litre

Power

35 kW at 3500 r/min

Torque

107 N.m at 2500 r/min

Transmission

Xtrac single-speed (4,588:1 reduction box)

Battery type

Lithium-ion phosphate

Battery capacity

1 000 A

Peak power

300 kW

The petrol engine that acts as a generator, an ultra-compact 35 kW Lotus three-cylinder 1,2 litre, has been purpose-designed for its range-extending role. It operates between crank speeds of 1 500 and 4 000 r/min.





HONDA CIVIC NOW HEAR THIS

There's a lot of truth in the view that if you want to improve fuel economy, start with the driver. So, despite all the high-tech design aerodynamic tweaks and lightweight materials, there's one component all the new "green" drive systems have in common: some kind of driver behaviour adjuster. We've become accustomed to a fuel consumption readout and, more recently, a gearshift indicator to prompt the driver to shift into a more appropriate gear, usually higher. Honda's Civic adds coloured bands on the edge of the driver's line of vision that glow an icy blue if you're being extravagant, or a lush green if you're an economy champ. Clicking the Economy button on the dashboard lights up a leafy logo in the instrument cluster to remind you that you're in Eco mode – not that you'd have missed the significantly less enthusiastic throttle pedal response that follows. In the event, largely thanks to obediently following the in-car nanny's promptings, our initial around-town figure of 8,4 litres/100 km dropped pleasingly to 7,0 despite a dash out to the country trying to make up lost time in the Honda Civic sedan.

Comprehensively equipped with lashings of gadgetry, leather and a smooth-revving, punchy 1,8-litre engine, the Civic is quite

the "pocket battleship" upscale compact sedan.

Coincidentally, at the same time as we were test-driving the sedan, Honda launched the **5-door version** of the Civic. With a design aimed at Euro buyers, the Civic is likely to grab attention on the local market.

Honda's love affair with high-tech displays continues: the instrumentation incorporates Honda's intelligent Multi-Information Display (i-MID), a colour TFT screen that shows vehicle, entertainment, Bluetooth connectivity and support-related data.

It's lower and wider than before, but its practical aspects include what Honda says is the roomiest interior of any car in its segment and a class-leading 401 dm³ boot. A full suite of safety features, from airbags to stability control, is standard.

Engines on the Civic are the familiar 1,8-litre petrol Four, now producing 104 kW at 6 500 r/min and more fuel-efficient than before, and the 2,2-litre i-DTEC turbo-diesel, rated at 110 kW.

Honda says it has completely revised the Civic's suspension and electric power steering system to improve handling, comfort and stability.

Prices (5-door): from R248 000. Including a 5-year/90 000 km service plan.



CITROËN DS5

BRING ON THE BIG GUNS

The third model in the DS line-up moves the marque into the expensive seats.

Citroën sees the DS5 as a new take on the premium segment, combining a spacious interior with compact external dimensions.

The DS5 range consists of three engine variants – two turbocharged petrol engines developing 115 kW or 147 kW and a diesel developing 120 kW with 6-speed transmissions.

Technology highlights, model-dependent, range from intelligent traction control to a full colour heads-up display and a reverse parking camera. Optional extras include a second-generation lane departure warning system and automatic activation of high beam assist.

Prices include a 5-year/100 000 km service plan and start at R344 900.





VOLKSWAGEN CC

TOP DRAWER

Volkswagen's CC flagship doesn't have to stand back to any of the comparable offerings from the usual premium brands. In terms of perceived quality and performance, this four-door coupé comfortably fits the mould. Whether buyers will see it as such is another matter, of course: the opposition is formidable – and some of it is from within the ranks of the VW Group itself, in the form of the Audi A4.

For 2012, the CC gets a new face with standard bi-xenon headlights (LED daytime running lights standard on the V6) and a remodelled tail with LED lighting.

Often it's what you don't see that has the greatest effect: an example is the reduction of several dB in noise intrusion thanks to extra acoustic film layer used on the windscreen, in addition to extra sound-absorbing materials – including underbody trim, wheel-well shells made of noise-damping material and improved gearbox mounts.

We drove the CC on a mix of Gauteng freeways and arrow-straight Free State trunk routes – where its abilities were not stretched in the least. Luck of the draw confined us to the 2-litre turbo-diesel (a 2,0 direct injection petrol Four and a 3,6 petrol V6 are also available).



Our leisurely cross-country lope registered a handy 5,3 litres/100 km overall – what price hybrids?

Perhaps the CC's only dynamic area that might be a turnoff to potential buyers is its ride quality. Well controlled as it is, the ride may just be a trifle firm for those more accustomed to plushness.

We're also mildly taken aback at the long options list. Among the available high-tech systems are:

- Light Assist, which is camera-based, analyses the light sources in night-time traffic to activate normal or high beam depending on whether there is an approaching vehicle.
- Park Assist is a second-generation system that uses ultrasonic sensors to select and steer the car into either a parallel parking or alley docking position.
- Easy Open allows the boot to be opened hands-free by making a kicking motion near the bumper.

Prices start at R373 800, including a 5 year/100 000 km maintenance plan.

Stay alert. New for this year is the fatigue detection system fitted as standard. It detects waning driver concentration and warns the driver with acoustic and visual signals. At the beginning of each car trip, the system analyses the driver's characteristic steering behaviour. The fatigue detection system then continually evaluates signals such as steering angle and warns if it spots deviations from the pre-recorded behaviour. Besides this, when the system is activated it recommends a break after every four hours of continuous driving.



GENEVA MOTOR SHOW

At the 2012 Geneva Motor Show, carmakers showcased lots of next-generation hybrid technology but mostly avoided defaulting to the brown-wrapper eco look. Also, there was some astonishingly hot stuff, such as an Infiniti we really hope they build.

HYUNDAI I-ONIQ CONCEPT

What: A swoopy hybrid study with 120 kilometres of electric range, plus a 1,0-litre three-cylinder engine. Size: Honda Civic. Details: It's pretty, but the design hints too strongly of other brands to see it on the streets in this wrapper.



2013 MERCEDES A-CLASS

What: A Baby Benz to firmly cement the notion that small equals luxury (and eat Mini's lunch). Size: Ford Focusish. Details: A diesel and seven-speed dual-clutch gearbox may also arrive.



NISSAN HI-CROSS CONCEPT

What: A hybrid crossover with a 2,0-litre four and an electric motor. Size: ix35. Details: This hybrid dances to both FWD and AWD beats, perhaps giving Nissan a cheaper way to hybridise all its crossovers.



RENAULT TIMES 3

The annual Knysna Hillclimb has morphed into a Speed Week and, as it's grown, has attracted headline sponsorship from Renault. It's been Renault's habit to combine the high-octane razzmatazz with a new-model introduction. Or, as in this case, three of them.



SCENIC

The big news about the Scenic is the introduction of a 1,6-litre diesel to replace the 1,9. Our run at the wheel was all too brief, fortunately with a couple of testing climbs thrown in, but even that short spell was enough to persuade us that the new engine's lusty torque delivery seems well suited to the Scenic's fairly hefty body. Economy seems great, too. All in all, a worthy alternative and a worthwhile

upgrade from the existing 1,9. The all-new 1.6 dCi turbodiesel is the first of a series of Renault Energy engines to be introduced here. You'd hardly think it, but like its flashier high-performance stablemates it, too, has benefited from the company's F1 experience.

Its tech features include six cutting-edge CO₂ technologies, including a Stop-and-Start system combined with deceleration/regenerative braking, and boasting a raft of patents.

According to Renault, the 1.6 dCi Energy is the world's most powerful engine of its size. Peak outputs are 96 kW and 320 N.m at 1 750 r/min (20 N.m more the 19 dCi it replaces. Combined-cycle fuel consumption is 4,4 litres/100 km and CO₂ emissions are just 114 g/km. That's impressive.

At the top end, Renault has introduced a 110 kW 2.0 dCi on the Grand Scenic Bose Edition, with a 6-speed automatic



transmission. The Bose in the title refers to the premium sound system specially developed for this model, which also features park distance control incorporating a rear-view camera, Xenon headlights, and an athermal and acoustic windscreen.

New technologies standard across the range include Hill Start Assist, which is linked to the electronic stability programme. Price: R324 900 (1,6 dCi) and R379 900 (2,0).

KOLEOS

While the competitors were preparing to hammer away at each other up Simola hill, we were rumbling down it in the latest edition of an SUV that has made people sit up and take notice. Headline news for the 2012 Koleos is new styling, smart tech for more safety and convenience, 4x2 or 4x4 drive and a simplified range with only a 126 kW 2,5-litre petrol engine available.

It was, in fact, our first ride in a Koleos and if first impressions are anything to go by the Koleos fans have good reason to be enthusiastic. The car's supple, composed ride at speed on the rutted, muddy dirt roads in Knysna's hinterland was superb. With all driver aids engaged, it gamely stuck to the chosen line and resolutely resisted attempts to unstick the rear end – well, mostly, until I managed to get it horribly sideways coming out of a greasy bend.

As well as being a superbly capable machine, the Koleos is also highly practical. There's all of 70 dm³ of stowage incorporated into the dashboard and the centre console, together with under-seat and floor compartments, as well as a 28-litre underfloor storage compartment. Naturally, there's a list of standard features as long as your arm.

Should you need to go actually off-road, you'll be pleased to know that the new Koleos boasts ground clearance of 206 mm and all-wheel drive that can be operated in Auto, 4x4 Lock or 2WD mode. All 4x4 derivatives also come standard with Hill Start Assist (HSA) and Hill Descent Control (HDC).

In short, in conditions ideally matched to a soft-roader's abilities, the Koleos is totally confidence-inspiring. Hey, these days it's even good-looking.

Prices start at R289 900 including a 5-year/100 000 km service plan.

MEGANE RS

The sinuous forest roads around Knysna are somewhat reminiscent of the fabled Nurburgring, which seemed appropriate, given the Megane RS Trophy's recent giant-slaying effort on the ring. By circulating in a front-wheel-drive record 8:07,97, the RS has outpaced some pretty exotic machinery.

To be honest, there was no real opportunity to stretch Renault's hottest hatches beyond dragging down Plettenberg Bay airport's runway.

The RS engine, said to be derived directly from Renault's Formula One involvement, churns out a massive 195 kW (the SI equivalent of the 265 horsepower referred to in the car's full name of RS Trophy 265). It's a revision of the existing 184 kW 2,0-litre unit – mainly involving a higher boost pressure of 2,5 bar and a new air intake design. Even so, it's more economical than the 2010 Megane RS 250.

The new engine is due to be spread across the regular Mégane RS range, including the Sport and Cup.

In the Trophy 265, the performance-oriented Cup chassis is standard, matched to a limited slip differential and unique Formula One-inspired Bridgestone Potenza RE050A asymmetric 19-inch tyres. Performance? Thought you'd never ask: 0-100 km/h in 6,0 seconds and a top speed of 254 km/h.

Prices: RS Trophy R409 900; RS Cup R399 900; RS Sport R359 900.





MITO

ALFA ROMEO TCT

CHANGING UP

Alfa has thrived on a reputation for sportiness. In the eyes of many, particularly the more rabid Alfisti, this equates to a manual shift. That said, Alfa is also pitching itself as trendy – and fashionistas may just view a stick shift as old fashioned, not to mention hard work. It's the perfect gap for the Twin-Clutch Transmission, TCT for short.

With one clutch for the odd gears and another for the evens, it is more or less permanently primed for action. We certainly found it unobtrusive, slick and easy to use on our jaunt around the Cradle of Humankind. Given the rate at which alarmingly mountainous speed bumps are sprouting around the area's roads, an auto-shift turned out to be a blessing.

In the Giulietta, the TCT is mated with the 125 kW 1.4 Turbo MultiAir engine, enabling the car to accelerate from 0 to 100 km/h



LEXUS GS

MEAN AND LEAN

Attitude isn't a word that you'd ordinarily have associated with Lexus. But it's become increasingly apparent that Toyota's premium brand isn't content to let the product's intrinsic qualities speak for themselves. Once renowned for being the quintessence of blandness, they're actually introducing an element of ... well, badassness. Case in point: the front end of the new GS. They call it the spindle grille, and it's a look you'll see on future models. Thing is, there's a suggestion of aggression, of "overtaking presence". When married with the more aero F Sport chin section, that suggestion turns to confirmation. Even if it does raise an eyebrow to find F Sport badging on the Save the Planet poster boy hybrid version.

Our test drive of about 350 kilometres from the Cape

Winelands through the Breede River Valley and back via the Overberg took in some challenging mountain passes, sweeping motorways and (we'll go to our graves insisting we didn't take a wrong turn) several kilometres of gravel. My co-driver preferred our first mount, the 233 kW 350. I liked its sonorous V6 howl when prodded hard for overtaking and its supple yet composed ride. Yet, when I took the wheel of the 450 hybrid, I immediately sensed that it felt more urgent, more ready for action. It also had that seductive sensation of almost bottomless urge, served up without fuss or drama, when slow-moving traffic needed to be passed swiftly and safely. It certainly rode firmer, but even on our unplanned gravel excursion it was on best behaviour.

The range consists of four derivatives, with (for the first time in South Africa) a V6-powered 154 kW 2,5-litre GS 250 entry-level model. The 350 and two 450h models – F-Sport and SE all use a similar V6. In the 350 the engine delivers 233 kW, but in the hybrids it is limited to 213 kW and mated with an electric motor for a total output of 252 kW. The electric motor 275 N.m of torque and the drivetrain as a system is coupled with an E-CVT continuously variable gearbox and special F-Sport dynamic mechanical enhancements. F-Sport features firmer springs, adaptive variable damping, thicker anti-roll bars, a variable gear ratio steering system, bushing changes and larger front brakes with high-friction pads.

The GS's impressive list of interior appointments is headlined by what is described as the world's first 31-cm Electro

Multi Vision display screen. A new-generation multimedia system makes full use of the extra screen real estate, and commands via Lexus' updated remote touch interface "mouse", are now more intuitive.

What's billed as a first on a hybrid car is the F-Sport's Lexus Dynamic Handling (LDH) system, with Dynamic Rear Steering (DRS). This new technology integrates DRS, Electric Power Steering and Variable Gear Ratio Steering (VGRS). Monitoring vehicle speed, steering direction and driver inputs, the system calculates the optimum angle for all four wheels.

Prices range from R494 400 to R771 700.



marginally quicker than the manual version. The improvement in economy is more eyebrow-raising: from 5,8 to 5,2 litres/100 km. And, of course, the Giulietta is still the highest-scoring compact car ever on the Euro NCAP safety ratings.

The MiTo TCT's 1.4-litre Turbo MultiAir engine is less powerful at 100 kW, and betters its manual equivalent handsomely in both acceleration and economy.

Prices, including service plan: MiTo 1.4 Turbo MultiAir Distinctive TCT, R265 000; Giulietta 1.4 Turbo MultiAir Distinctive TCT R315 000.

Doubling up. Essentially two gearboxes in parallel, one for even gears and one for odd gears, each with its own dry clutch, TCT allows the selection and engagement of the subsequent gear while the previous one is still engaged. Changes are so



MITO



GIULIETTA

quick, the torque flow is almost seamless.

According to Fiat, it's designed to provide a drive that's comfortable yet sporty, while improving efficiency – cutting fuel consumption by up to 10 per cent compared with a traditional gearbox. Like other autoboxes, it can operate fully automatic or sequentially.



TOYOTA ETIOS

A WHOLE NEW WORLD

The Etios has a big act to follow: that act being the hugely successful Tazz. The new built-in-India Etios is aimed at buyers who want affordably priced, practical transport. And Toyota says the Etios has plenty going for it: biggest-in-class space, big-capacity engine, and a good balance of cost vs features. Both sedan and hatchback are five-seaters, and the sedan has a massive 595 dm³ boot.

Dynamically, the Etios feels well up to the class standard. The 1,5-litre four-cylinder petrol engine develops 66 kW and 132 N.m at 3 000 r/min. Adapted to suit the South African market, it's

mated to a five-speed manual transmission, and returns 5,9 litres/100 km (sedan) and 6,0 litres/100 km (hatch).

The Etios rides comfortably and assuredly; the steering lacks feedback, but is precise. It corners nice and stably with mild body lean at speed. There's adequate torque available for snappy overtaking manoeuvres (down at sea level, at any rate) and the 5-speed manual gearshift is light and slight.

One aspect I simply can't get attuned to is the instrument panel. Firstly,

because of its location in the centre of the dashboard; secondly, because of its garish graphics. There has to be a classier way of doing this, Toyota.

It's particularly well equipped on the safety front: anti-lock braking with electronic brake-force distribution and airbags for both front occupants are standard.

Standard features include electric power steering, air-con, tilt-adjust steering and, on XS models, remote central locking, power windows all round and rear window demister. The glove box has a built-in cooling function, too. One rather unusual feature is seven (seven!) 1-litre-sized cupholders. Just so you know.

Prices range from R115 800 to R126 600, including a 2 year/30 000 km service plan and ToyotaCare 24-hour roadside assistance.

PM



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NEWS BLOGS MULTIMEDIA SCIENCE TECH WHEELS DIY MAG GADGETS WIN SUBSCRIBE

JETMAN FLIES OVER RIO



Yves Rossy, known as the Jetman, flew past Christ the Redeemer statue on Corcovado Mountain during a successful flight over Rio de Janeiro, Brazil, on 2 May 2012. The Swiss aviator dropped from a helicopter and deployed the jet-powered carbon-kevlar Jetwing, using his body to steer as he flew over the Brazilian capital before landing on Copacabana Beach. Check out the video on www.popularmechanics.co.za (search keyword: Jetman) and/or scan the QR Code alongside to view the awesome images.



Check out both videos using the QR codes provided (if you don't own a tablet or smartphone, you can watch the videos on www.popularmechanics.co.za).

YOUR TWEETS

@smillicus Just got my new @popmechsa in the mail. Perfect reading for the rainy @CapeTown weekend yfrog.com/odik5eqj

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PM TRIP TO SAAO SALT



From 18 to 20 May, POPULAR MECHANICS, along with Faircape Travel, hosted a highly successful, fun and informative trip to the Southern African Large Telescope (SALT) and the South African Astronomical Observatory in Sutherland, via quaint Matjiesfontein. Scan the QR Code alongside to view the photo album.



SPOT THE FOCUS

Take your picture with PM's Ford Focus and upload it to our Facebook Page via the "Spot the Focus" app. You could win a Wise Touch Tablet and HUAWEI Modem worth R2 990. Enter at www.popularmechanics.co.za/facebook



COMPETITIONS

Visit www.popularmechanics.co.za to enter our competitions:

You could win **shoX maxi speakers** worth **R200** or **shoX solo speakers** worth **R400**, courtesy of Tevo.



Win **one of two Skil Masters 5064AA circular saws** – each worth **R749**.

Win **one of two Solar Courtyard Lamps** worth **R1 495** each, courtesy of The Green Shop.



DCC and PM are giving you the chance to win **one of two Philips DC390 Docking Systems** – each worth **R1 400** – for your iPod, iPhone or iPad.



Win **one of three Tivoli Audio Model One radios**, each worth **R1 990**.

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WASTED POWER

In today's switched-on household it's not uncommon to find a couple of dozen consumer electronics products, many with chargers or "always-on" features such as a remote control that draw a constant trickle of electricity.

ENERGY CONVERTER

When the detector's antenna picks up electromagnetic waves, it sends the voltage to the Arduino, which converts the info to a tone emitted by a speaker.

AUDIBLE SOUND

The tone will sound lower near a charging cellphone – which draws 3,7 watts of electricity on average – than near a DVR, which draws nearly 40 watts on average even when turned off.

Arduino microcontroller
8-ohm speaker

POWER BALLAD

> BY EMILY GERTZ

WHEN I STARTED learning DIY electronics, using Arduino was the obvious choice. This palm-sized single-board microcontroller, which can be easily swapped between projects, is designed for programming novices. Yet it has more on-board processing power than the navigation computers used by Apollo astronauts – and at just a couple of hundred rand a pop.

These qualities make Arduino the go-to component for building DIY environmental-monitoring devices, such as the electromagnetic interference (EMI) detector shown here. Because it converts invisible electric vibrations into audible sound, it's handy for identifying sources of standby power: the energy that flows constantly through electronics, even when they're supposedly off. Cut the power to those electronics between uses and you'll reduce your electric bill and your carbon footprint.

When you're ready to build something new, take this gadget apart and reuse the Arduino in your next project. Try that with a watt meter from the hardware store.

PM

PROJECT: ELECTROMAGNETIC INTERFERENCE DETECTOR

ROUGH COST:

TIME COMMITMENT:

SKILL LEVEL:

WHY MAKE IT:

INSTRUCTIONS:

R300

about 1 hour

easy

this is a DIY electronics skill-builder with a practical application – reducing standby power, which can make a significant impact on residential electric bills.

popularmechnics.com/emidetector

EMBRACE your techno-future!

After three groundbreaking years as host of the annual PM Inventors Conference, POPULAR MECHANICS is launching a new and even more ambitious event that's destined to light a fire in South Africa's vibrant tech community. Titled **FutureTech**, it's a forward-looking conference aimed at anyone who cares where their world is heading, embracing and celebrating technologies that are already changing our lives beyond recognition.

Breathtaking advances in computing power, the explosive spread of wireless connectivity, the ever-evolving Internet, breakthroughs in consumer tech, the social media landscape, humanity's relationship with technology, our automotive future... all this, and more, will be tackled by presenters at the top of their game. They'll introduce a slew of fascinating concepts, deconstruct the most significant breakthroughs, and reveal what's coming next. The theme of the inaugural conference is "**Connect**", a word that will resonate with anyone who understands the mechanics of the 21st century.

The inaugural **FutureTech** conference happens on 25 October 2012 in Johannesburg; bookings are open now. To reserve and pay for your seat, please visit www.magsathome.co.za. For more information, e-mail Nomfundo Calana on nomfundoc@ramsaymedia.co.za with "**FutureTech updates**" in the subject line, or call her on 021-530 3204.

In the meantime, here's a taste of what's to come (more programme details will follow in the coming weeks):

GEORGE ELLIS, Emeritus Distinguished Professor of Complex Systems in the Department of Mathematics and Applied Mathematics at the University of Cape Town. Professor Ellis co-authored *The Large Scale Structure of Space-Time* with University of Cambridge physicist Stephen Hawking (in 1973), and is considered one of the world's leading theorists in cosmology.

HIS SUBJECT: "Science, Technology and Humanity."



TIM NOAKES, Professor in the Discovery Health Chair of Exercise and Sports Science at the University of Cape Town. He is also director of the UCT/MRC Research Unit for Exercise Science and Sports Medicine, and co-founder (with rugby legend Morné du Plessis) of the Sports Science Institute of South Africa.

HIS SUBJECT: "Your Body, Your Future: Getting the Science Wrong."

ALAN KNOTT-CRAIG is founder of *World of Avatar* and CEO of Mxit, Africa's largest social network. Between 2003 and 2006, he co-founded five companies in the mobile services sector. He's a former MD of broadband network operator iBurst and author of the best-seller *Don't Panic*, a book aimed at persuading emigrant South Africans to return home.

HIS SUBJECT: "In Pursuit of a Better-Connected Planet."



JAMES MUNN is vice-president of business development in sub-Saharan Africa for wireless giant Qualcomm. Based in Johannesburg, he manages Qualcomm's strategic relationships with OEMs and the company's regional customers, including network operators and carriers, mobile handset vendors and software developers.

HIS SUBJECT: "How Wireless Rules the World."



PITCH IT TO THE PANEL. Reprising a popular segment from last year's event, we'll be inviting finalists from our annual PM Inventors Competition to present their inventions to our panel of experts (and to you, the audience) for comment and advice. You'll be impressed and inspired by their home-grown ingenuity.

JUST THE FACTS

- The one-day FutureTech conference takes place on 25 October 2012 in Johannesburg.
- Only 200 seats are available at an "early bird" cost of R1 595 each (offer closes on 31 August 2012). Thereafter, the fee increases to R1 895.
- All bookings close on 12 October 2012. Updates will be announced via our Web site, our weekly Web letter, our Facebook page and other media channels.

futur^etech2012

Popular Mechanics

TOMORROW'S TECHNOLOGY TODAY ● Popular Mechanics Be the first to know

THE DIRT:

Clay loam or topsoil mixed with clay is best. A 12 x 10-metre area takes 25 cubic metres.

HAND TOOLS:

Wheel-barrow, spades, string and dowels for layout, a soil compacter.

THE MACHINE:

Yes, this counts as an excuse to rent an earthmover.

Maximum roller height = 450 mm

Minimum BMX track dimensions = 6 x 6 m

Minimum distance between rollers, measured crest to crest = 3 m per 30 cm of roller height.

Radius of banked turn = 3 m

Maximum berm angle = 70°

MCCORMACK'S TRACK TIPS

DESIGN: Avoid flat spots. Every square centimetre should tilt up, down, or sideways, to keep momentum going.

SITE: Build on a 3 per cent slope to avoid flooding. Got a flat area? Dig French drains at the berms.

CONSTRUCTION: Pile infill 50 per cent higher

than the final dimension to account for compaction. Then carve out the contours. It's almost impossible to get a nice shape by adding dirt. It's easier to move it.

MAINTENANCE: Run a sprinkler to soak the track lightly before each ride. Let it nearly dry, and then pedal like crazy to burn in a line.

RIDING: Ratchet the pedals in short quarter-turns and push down with your arms off the backsides of rollers. Don't pedal continuously.

WORKOUT: The top priority is fun, but pump tracks also build core strength and balance skills.

California BMX track builder Mark Weir.

BUILDING A BMX TRACK

Bikercross meets backyard in this cool DIY track – all you need are dirt and two wheels.

> BY MICHAEL FRANK

Any kid who has built a bike jump has probably dreamed of something like a BMX track, a loop of banked turns, rollers and benches that can feel like a perpetual motion machine. Imagine a motocross circuit at one-tenth scale, but meant

for mountain bikes or a BMX. When Mark Weir finished the BMX track at his home, local kids swarmed – and their dads asked Weir to build tracks in their yards, too. Now he is working on an R8 million version for a nearby resort. "Once you start, you have to realise

the addiction that comes with it – all of a sudden you're more of a builder than a rider," he says. To get the advice laid out above for DIY builders, we turned to Lee McCormack, who wrote the book *Welcome to Pump Track Nation* and has created hundreds of tracks. **PM**

Rent this!



Cooking with SMOKE



BY JOE KOHL-RIGGS

A STEEL DRUM AND A FEW PLUMBING PARTS MAKE UP THIS NO-WELD SMOKER. ADD MEAT AND SMOULDERING WOOD – AND PLAN TO FEAST!

Joe Kohl-Riggs inspects his ingenious slow cooker. After gathering the parts, he built it in just a few hours.



Men can admit that they like a barbecue (as in slow cooking over the coals, not grilling as one would with the typical braai). The reason for that is because it's not really cooking – it's a DIY project that ends with eating meat.

After a few years of cooking with smoke, I got good at it. Then, after a few more years, I fancied myself a magician, shrouding my cheap cuts of meat in the mystery of secret-recipe dry rubs, brines, sauces and blends of flavouring woods. But it wasn't enough.

I wanted to own every step of the process. My landlord said no to raising livestock in the apartment, so that left building the smoker itself to express my rugged individualism. Online research led me to the ugly drum smoker, which rightfully enjoys a cult following. Using a 200-litre steel drum and parts found in any decent hardware store, the design produces an exceptional smoker. Building it is like the classic barbecue itself, turning modest ingredients into something truly satisfying.

PARTS LIST

BODY

- One 200-litre steel drum, open head, no gasket or lining

COOKING GRATE AND SUPPORTS

- Three M6x25 mm bolts, plus nuts; stainless steel
- Six flat washers, 6-mm hole and 25-mm outer diameter; stainless steel
- One cooking grate, 545-mm diameter (Weber part No 7435; fits 570 mm kettle grill)

INTAKE ASSEMBLIES

- Four 20-mm, 60-mm-long threaded pipe; Sched. 40 black iron
- Four 20-mm close-nipple pipe fittings; Sched. 40 black iron
- Four 20-mm locknut pipe fittings; Sched. 40 black iron
- Four 20-mm 90-degree elbow pipe fittings; Sched. 40 black iron
- Four U-bolts, 57-mm inside length (to fit 20-mm pipe); 10-mm threads; stainless steel
- Four 20-mm ball valves; brass; female connection

HANDLE

- One 12-mm close-nipple pipe fitting; Sched. 40 black iron
- One 12-mm flange pipe fitting; Sched. 40 black iron
- One 12-mm to 6-mm reducing elbow pipe fitting; Sched. 40 black iron
- One 6-mm, 150-mm-long threaded pipe; Sched. 40 black iron
- One 125-mm long spring handle with 16-mm hole diameter; stainless steel
- One 6-mm cap pipe fitting; Sched. 40 black iron
- Four M12x40 mm bolts and nuts; stainless steel

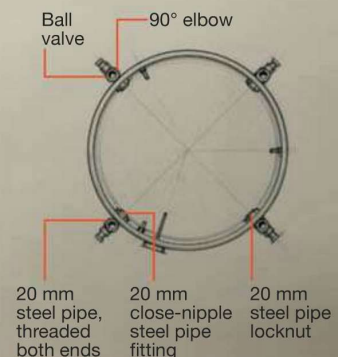
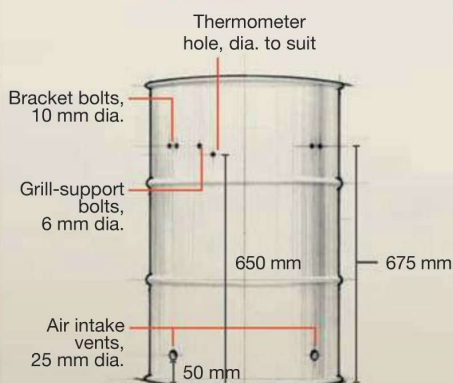
FIRE BASKET

- One 300-mm x 1,2-metre piece of flattened, expanded metal; 40-mm hole; 1,5-mm plain steel
- One charcoal grate, 340 mm diameter (Weber part No. 7440; fits 470 mm kettle grill)
- Six M6x25 mm bolts and nuts; stainless steel
- 12 flat washers; 6-mm hole, 25 mm outer diameter; stainless steel
- One length of 1,63 mm diameter; stainless steel

OTHER

- One barbecue thermometer
- Eight plugs, 6 mm pipe size; stainless steel

Hole Placements



GLOSSARY

PIPE SCHEDULE

In 1927, the American Engineering Standards Committee standardised the measurement of steel and iron pipe sizes and strengths. This led to the pipe schedule, a scale of 5 to 160. As the number grows, so does a pipe's wall thickness and ability to withstand internal pressure.

THE BUILD



1 ASSEMBLE THE FOUR AIR INTAKES

Using 20-mm threaded pipe and fittings (see parts list), connect the close nipple to the 90-degree elbow and the elbow to the 600-mm pipe. Slip a U-bolt and mounting plate over the pipe, then attach the brass ball valve (positions shown above). Hand-tighten the parts (below). Then clamp the elbow in a vice, and secure the connections with a spanner on the valve's facets.



2 MAKE THE LID HANDLE

Hand-tighten a 12-mm close nipple into the flange pipe fitting (above, centre). Align the 12-mm opening of the reducing elbow over the nipple, and turn the elbow on to it. Thread the 150-mm-long piece of 6-mm pipe into the elbow, and tighten the connection with pliers. Slip the spring handle over the pipe, and thread the cap on the pipe's end to hold the handle in place. The entire assembly will be bolted to the lid (left) in a later step.



THE DELICIOUS CHEMISTRY OF SMOKING

Smoking takes 3 to 18 hours or more and occurs over indirect heat maxing out at 100 to 120 degrees. Tough cuts such as beef brisket and pork shoulder make the best barbecue because they contain a lot of collagen protein, which forms the fibre that surrounds the lean muscle. Over low heat, collagen breaks down into gelatine, which is as tender as, well, jelly. In lab speak, the collagen converts into hydrogen and hydroxide. This process, which occurs most readily at 60 to 70 degrees, makes the meat moist. By contrast, when a tough cut is prepared at high heat (say, in a 250° C oven), the muscle fibres cook through before most of the collagen converts to gelatine. The result is a tougher, drier finished product.



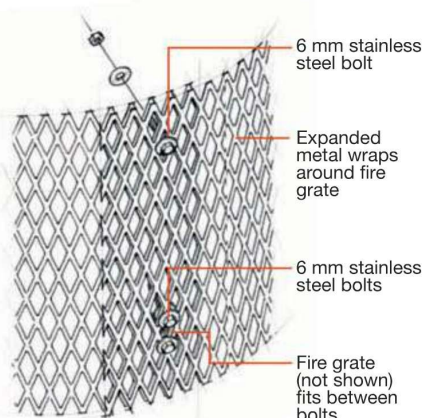
3 CONSTRUCT THE FIRE BASKET

Cut a 300 x 1 200 piece of expanded metal. The best way to do this is to mount the material to plywood with drywall screws, mark the dimensions on it, and make your cuts with an angle grinder and cutoff wheel (above). Then mark the metal lengthwise 60 mm from the bottom; align the charcoal grate on the mark, and roll the metal into a cylinder (below, left).

Where the metal overlaps, secure the cylinder using three M6 stainless steel bolts, washers and nuts. Use



two bolts above the grate and one below it; then space the remaining three bolts evenly around the basket's circumference. Form the handle out of stainless steel wire. Thread one end through the basket and twist the wire back on itself. Take the free end of the wire and do the same at the other side of the basket.



5 FIRE IT UP

Before you cook, load the fire basket with untreated charcoal, ignite it (use a coal chimney, not lighter fluid), and attach the lid. Fiddle with the intakes to make sure they're working, and let the fire burn hot to season the barrel and remove any impurities. After this dry run, stoke 3 to 6 kg of charcoal in the fire basket, and add two or three fist-size chunks of flavouring wood, such

as cherry, hickory, oak or maple. Place the basket in the smoker and the grill on its supports. Drop on the lid and open the intakes. When the thermometer reads 175 degrees Celsius, close all but one valve to reduce the heat. Dial in a temperature from 100 to 120 degrees by adjusting the intakes. Load the grill with meat and settle in for the long haul with some good company. **PM**

4 PREP THE BARREL

Use a 200-litre food-grade drum with an open head. (Some drums are treated with epoxy to prevent rust, but meat smoked in such a barrel is toxic.) You can buy a new drum at an industrial-supply store. Make sure that the drum and lid are untreated, and buff their insides with a scouring pad or fine sandpaper.

Mark a 290-mm-diameter circle centred on the lid. Using a step bit, drill eight equally spaced 12-mm holes around the circle. Thread a 6-mm pipe plug into each hole. Place the handle assembly on the lid. Mark the four bolt locations; drill them with the step bit. Bolt the handle to the lid.

Mark the hole locations for the air intakes, grill supports and thermometer. Start each hole with a centre punch and bore the 25-mm intake holes with a step bit (above). Test each one by threading in a 20-mm close nipple. Using a 6-mm bit, drill the grill-support holes. The hole size you make for the thermometer depends on the model.

Add the air intakes by placing the close nipple into each hole and rotating the assembly. Align the intakes vertically, mark the U-bolt locations, drill on the marks, and slip a faceplate on either side of the barrel wall. Then tighten the nuts on the U-bolt. Secure the air intakes at the barrel's base by threading the pipe locknuts onto the close nipples. Create grill supports using the M6 bolts, washers and nuts. Attach the thermometer with its included nut.



PERFORMING DIGITAL MAGIC (WITH HELP)

SHOOT, FIX AND SHARE WITH WI-FI, DUAL VIEWFINDER AND 'BEAUTY' TECH



COSMETIC SURGERY is a hotly debated topic – both about the need for it, and about its cost. The first of these is pretty much up to the individual; as for the cost, if you simply can't afford it, there's always Beauty Shot.

Admittedly, this new tech from Samsung will make you look better only in photographs. But it's a start.

Beauty Shot is one of three key technologies that highlight the new Smart Camera range, introduced at the company's Africa Forum. The line-up's other features, said to be specifically aimed at Africa, include dual view and Wi-Fi. It's not so much about the optical

technology and more about producing consumer experiences, says Dan Hee Kim, regional product manager for visual display and digital imaging at Samsung South Africa.

Beauty Shot is an intuitive technology that picks up blemishes and skin pigmentations and edits them out automatically. It also adjusts settings automatically for different skin tones and removes any dark or inconsistent tones.

And sharing those, um, unblemished images has become a lot easier. **Wi-Fi** functionality means that you can take pictures and upload them straight to Facebook and Twitter, or any other

popular social media stream for that matter, and via e-mail. The setup includes automatic back-up.

Finally, the most obvious of the three technologies is **Dual View**. Samsung says it's convinced that community and togetherness are important to people in Africa – hence its development of a camera that allows pictures to be taken together or singularly. The adjustable Dual View LCD screen can be used as a traditional camera, or the screen can be flipped upward to take self-portraits with friends and family, so that no one has to be left out.

Now go out there and get creative.

FROM A NICE PIECE OF GLASS)



THE SECRET TO INCREDIBLE PHOTOGRAPHS IS A GOOD LENS.

PRIME For those willing to zoom with their feet, prime lenses can deliver extraordinary photos. Because primes have a fixed focal length, they can offer optimal optics in a simple (read: not too heavy or bulky), cost-efficient package. There are prime lenses in every category, from wide-angle to telephoto, but a good starter lens is in the 35- to 50-mm range.

GOOD FOR sharp portraits with shallow depth of field.



ZOOM These versatile lenses have a range of focal lengths. Most DSLR or mirror-less cameras come with a relatively wide-angle zoom lens, but zooms can push way into the telephoto range. Nevertheless, zoom lenses are inherently compromises – either they can't deliver wide-aperture (that is, low f-stop) performance, or they are heavy, expensive beasts.

GOOD FOR situations when you can't carry a variety of lenses.



WIDE-ANGLE

The lower the focal length, the wider the field of view. Anything under 35 mm is typically considered wide-angle, but some specialty lenses can get down to 10 mm. Super-wide-angle lenses can cause distortion at the edges of the frame, but high-quality lenses can fight that effect.

GOOD FOR photographing interiors, where you can reverse only so much.



MACRO If a telephoto lens works like a telescope, macro lenses work like microscopes. A macro lens's best quality is its ability to maintain sharpness at high magnifications. Decent macro lenses can achieve 1:1 reproduction, meaning that the subject matter can be captured by the camera's sensor at life size.

GOOD FOR close-ups of flowers, insects and other little wonders of the natural world. **PM**



A good interchangeable-lens camera will do wonders for your photography. But if you're still shooting with the kit lens that came with your camera, you're missing out on many of the most sophisticated features of the system you bought into. Think of your camera bag as a golf bag – there's a lens for every type of shot.

GLOSSARY

ONE-WAY MIRROR

Made famous by TV cop-show interrogation rooms, these tricky mirrors let light through on one side and reflect it on the other. The reflective effect is negated when light passes through from behind the mirrored side, as is the case with our backup-camera display.



This reverse mirror from Peak Automotive hides a 640 x 480-pixel screen behind a one-way mirror.

20/20 HINDSIGHT

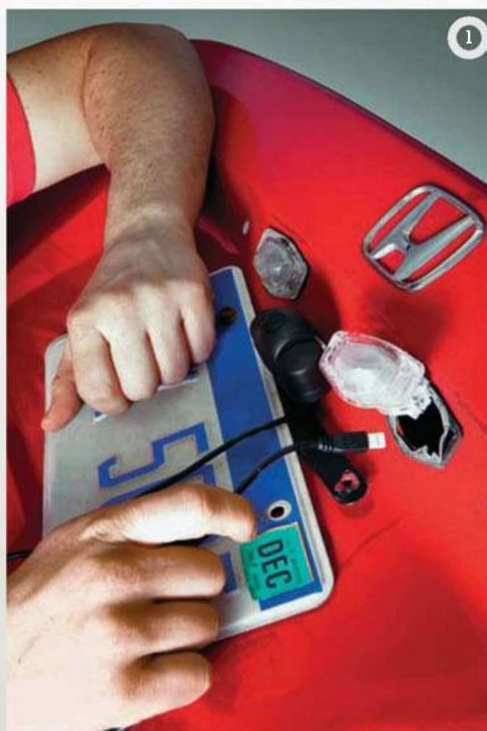
DEGREE OF DIFFICULTY **3/10**

Own an older car and want a reversing camera? It's a surprisingly cheap and easy upgrade.

Reversing cameras are a nearly universal option on new cars and will likely be mandated for all American cars by 2014. And for good reason: the compact cameras provide a view of what's behind the car, reducing the chance of reversing over a bicycle or, worse, the kid riding it. Plus, the device greatly eases parallel parking.

But, with average vehicle age rising steadily, the vast majority of cars and pickups don't have this feature. If you plan to keep your older car, but still want the peace of mind that comes with a reversing camera, it's not too difficult to install one yourself.

Aftermarket manufacturers now produce a wide array of DIY rearview camera kits. The cost varies, based on the size and resolution of the digital screen. For under R1 000 it's possible to buy a good balance of quality and easy installation. Our Peak Automotive wireless kit was installed in a 2003 Honda Civic. The hard part was opening the plastic clamshell package.



LOOK OUT BEHIND YOU

INSTALLATION

Our camera-kit installation didn't require a deep dive into the toolbox. All that was necessary was a spanner to remove the licence plate and some simple wiring tools. The kit has three parts: the camera, which mounts to the rear licence-plate bracket; a transmitter that sends video wirelessly; and a rearview mirror with an integrated screen. A signal wire runs from the camera through the boot or cargo area and plugs into a small control-box transmitter. You may need to get creative passing the wire to the interior. We snaked it behind a licence-plate light (1), but it might be necessary to drill a small hole in the boot or hatch and use the included grommet to protect the wire from the hole's edge. The transmitter is powered by splicing into the wiring for the reversing light (2), which is electrified only when the car is shifted into reverse. Mounting the camera took us all of a quarter of an hour, and we got a clean, nearly undetectable install.

Since video is transmitted wirelessly, we didn't have to run a signal wire through the cabin to the dashboard. Inside the mirror housing are the video signal receiver, a 640 x 480-pixel monitor hidden behind a one-way mirror, and a few control buttons to adjust the picture.

Installing the mirror is even easier than hooking up the camera. All we had to do was mount the new mirror over the old one (3). A spring-loaded clamp grabs to the top and the bottom of the factory mirror, and Velcro strips wrap around it to keep the kit mirror in place.

To power the new mirror, there are several options. Tuck the power cord that plugs into the top of the mirror into the front of the headliner. Then route the wire



The amount of work for installing a backup camera varies. This one's simple; other kits may require a run of wire through the cabin.

down the driver-side A-pillar, where you can hide it behind the trim and run it into the dash. Our A-pillar trim came off by hand, but yours might require a bit of work with a screwdriver or a trim-removal tool to get it free.

From here you can either plug it into the cigarette lighter or permanently install it into a keyed-on circuit. We chose the latter and tied into the fuse box with a splice to the radio circuit, which comes on with the ignition. Use a test light and your ignition key to find a circuit that makes sense for your car. The whole installation should take less than three-quarters of an hour if you're obsessive about it, 10 minutes if you aren't.

RESULTS

So how well does it work? Surprisingly well. We were impressed by how quickly the monitor and the camera start up when the car is turned on and shifted into reverse, especially for a fairly cheap piece of tech. The image is very clear (even at a 75-mm screen size), and the camera performs well in both high- and low-light situations.

There is, however, an idiosyncrasy we noticed while cruising through town. The mirror's receiver is always on while driving and constantly searches for the video signal from the camera. When it finds one, the screen is immediately turned on and displays the signal, regardless of where it's coming from. This is a bit strange when you drive through pockets of interference. On one or two occasions during a 60-kilometre drive the screen turned on and displayed a static pattern similar to what you'd get on a television tuned to channels with no signal. It didn't happen often, but in a big city with lots of electromagnetic interference, it could get distracting. The fix is relatively easy: turn the mirror off when you're cruising. We've decided this quirky behaviour isn't a big deal for such an easy and useful upgrade. **PM**

WIRE IT RIGHT



CRIMPER

The most indispensable wiring tool, it cuts wire, strips insulation and crimps connectors. Red, blue and yellow dots co-ordinate with coloured connectors. Strip by matching your wire's gauge to the size marked on the cutter.



WIRE

Pick the right wire gauge to carry the current for your device. Too small and the wire burns; too big and you're wasting money. For long runs, bump up the wire gauge by one size to offset increased resistance. In cars, use stranded wire – it resists breakage from vibration.

CONNECTORS

Ring, spade or blade?

A permanent install on a bolt: **ring**.

Awkward location, but rarely removed: **spade**.

Connecting one wire to another: **blade**.

Insulation is colour-coded for wire size:

Red: 1,3 to 0,6 mm diameter (16 to 22 AWG)

Blue: 1,6 to 1,3 mm (14 to 16 AWG)

Yellow: 2,6 to 2,0 mm (10 to 12 AWG)

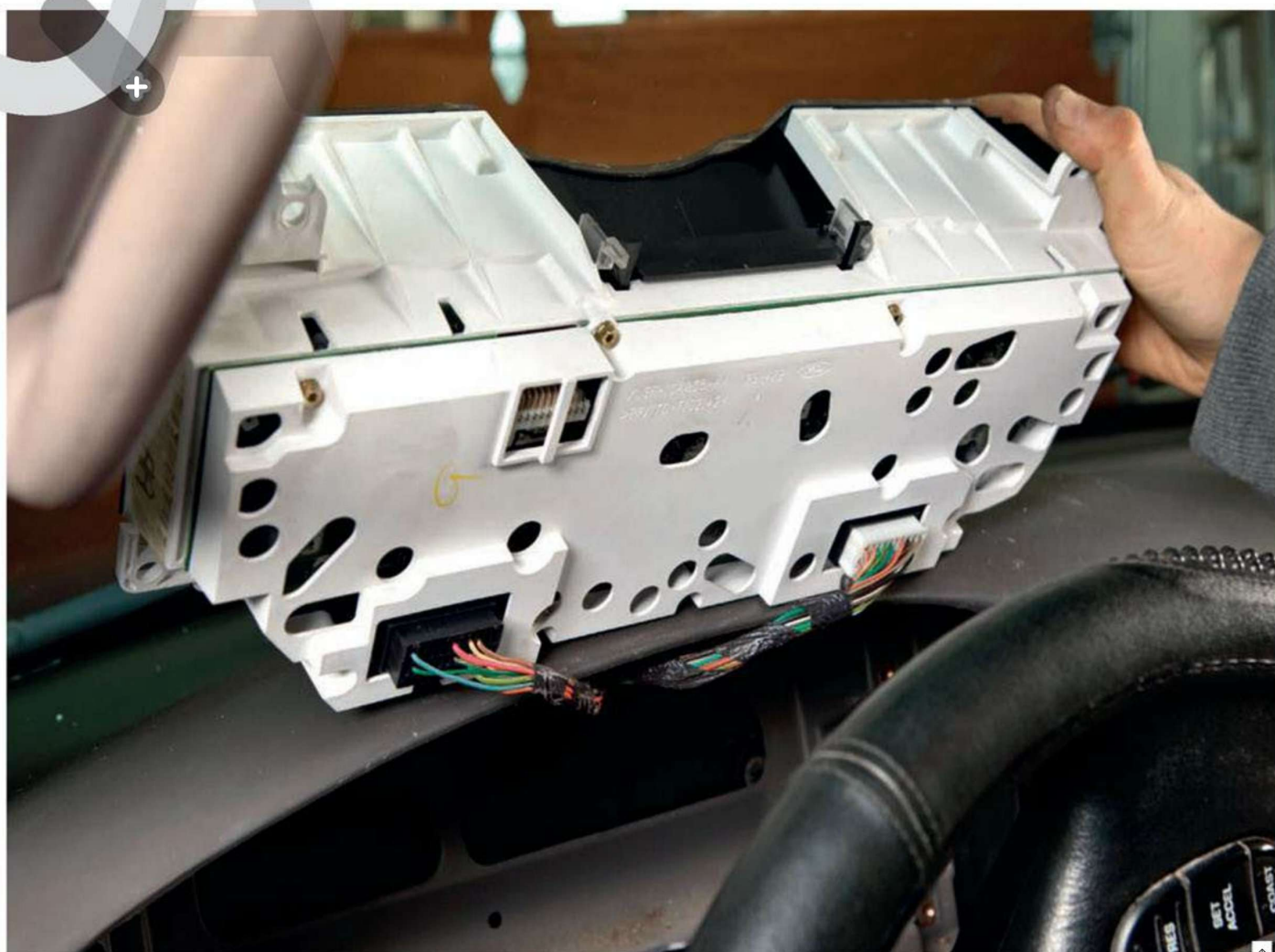


DON'T BE AN IDIOT OVERTIGHTENING BOLTS

It's tempting. You're putting something together and really don't want it to come apart – what harm could it be to put a bit more elbow grease into tightening those bolts? Use the old German torque spec: gut und tight. Unfortunately, overtightening can lead to problems.

First and foremost, you can damage the bolt by twisting the head off or stripping the bolt or hole threads. All bad news. Too much grunt can also cause premature failure in gaskets and bearings and cause the stuff you're putting together to just plain not work. Do yourself a favour: get a torque wrench, some specs, and do it right. It'll save a lot of pain down the road.





Picture by Brian Kelly

Gauge clusters come to the factory pre-built; plastic connectors (quick disconnects) supply power and signal to them. After many kilometres, these parts can get fussy.

PARTY LIGHTS

I have a '96 Nissan Pathfinder and my gauge cluster has started to go on the blink. It'll randomly cut in and out while I'm driving, with the gauges going from proper operation to flat needles and no light. I've checked all the fuses, but everything looks okay. Have any ideas?

A That's not a defect; it's a feature – interior strobe lighting! Seriously, though, if the fuses are fine, there are two paths to investigate and neither is much fun. This kind of thing can usually be narrowed down to a corroded earth wire or a bad connection between the gauge cluster and the main wiring harness. Clusters generally consist of one large circuit board with stepper motors to turn the dials, light bulbs or LEDs to brighten the instruments, and microcontrollers to make it all work. Everything is driven through inbound wires attached via plastic connectors.

Your Pathfinder has three of these connectors on the back of the cluster, and

one of them may have gone finicky. If you're going to fix it yourself, you need to be brave: the driver-side dash will have to come apart. Take your time and figure out how the unit was assembled; everything in a dash is built from the inside out, which means the last part on will be the first off.

Start with the trim and look for the bolts and screws that hold the structure together, slowly removing each piece while keeping track of all those nuts and bolts and snapping pictures as you go. Always consult a vehicle service manual, too.

Eventually you'll be able to pull the cluster away from the instrument panel and view its hindquarters. Inspect the

connections for signs of corrosion, which you can clean with solvent, and for breakage. If you don't see anything wrong, you're in for an arduous journey, tracing all the wires through the skeleton of the dashboard.

What you're looking for is a wire routed against the metal support structure. Over time the vibrations from the road may have worn a hole in the insulation of one such wire. As you drive, the exposed copper is earthing to the chassis, making the gauges do their little on/off dance. If that's not the case, you're looking at having to replace the cluster. This is not difficult, but it's usually quite expensive because the odometer has to be synced by a dealer.

COOLANT SUCKER

Q Can you use a wet-dry vac to evacuate antifreeze from a radiator with no drain plug?

A No. It's a clever thought, but sadly it's not realistic or good for the engine. First, you don't want toxic antifreeze in your wet-dry vac; when it dries it leaves a sticky residue that won't be fun to have in your vacuum. Second, because of the way radiators are made, you'll never remove all the coolant or the gross sediment that builds up inside. For these reasons, it's best to let gravity do the work and empty the coolant from the bottom.

If your car doesn't have a drain plug, pick out the lowest hose in the coolant system and loosen the clamp holding it in place. Before you pull the hose off, position a large bucket beneath the radiator to collect the old stuff. Now disconnect the hose and direct the flow of coolant into the bucket. It's a good idea to have a second bucket handy – you never know how much fluid is going to come out. You may also need to remove a plug in the engine block to get even more out; that varies from car to car.

To do a complete flush, reconnect the lower radiator hose and fill the system with clean distilled water. Run the engine for a few minutes until the cooling fan cycles on and off a couple of times. This prompts the thermostat to open and coaxes the coolant in the heater core to cycle through the rest of the system. Shut off the engine, wait for it to cool, and drain the fluid out as you did before. Be sure to properly dispose of the used coolant – remember, this stuff is deadly for pets, children and other living things (check with your local municipality or the ROSE Foundation at rosefoundation.org.za).

Now you can replace the coolant. Check the owner's manual to make sure you use the correct type. There are variations in colour – green and orange are two options – and chemistry, and coolants should never be mixed. The incorrect option can react very badly with the gaskets and the surfaces in your engine. Since there's bound to be some residual fluid in the cooling system – it's nearly impossible to drain the engine block – find out the coolant capacity, but realise you'll have to fill as needed. Add coolant and water alternately – a 50/50 mix is usually recommended – until the level reaches the top of the overflow tank or radiator.

When it's filled, start the engine and

let it run. The water pump will pull the coolant through the system. Add water and coolant as necessary to keep it filled. Once again, you'll want to keep the engine running long enough to open the thermostat so the heater core fills up.

One final note: I typically use distilled

water rather than the stuff from the tap. The minerals and purification chemicals in tap water may lead to corrosion and scaly buildup in the engine. Premixed coolant is also available. It costs more, but it is convenient.

PM



3

QUICK FIX

Replacing hatchback struts

1 Work safe(ish)

Prop open the hatch with a stick or pipe. You know, the one that's held it up for months.

2 Out with the old

Use pliers or a screwdriver to extract the retaining clips on both ends of the spring piston. With the screwdriver, pry out the pins on both ends and remove the piston. Swap any old hardware over to the new piston, and grease the pins for quiet operation.

3 In with the new

Place one end of the piston in the bottom mount and insert one of the pins you saved. Raise the other end into position, and push the upper retaining pin in. Then install both retaining clips. Repeat on the opposite side if necessary. Toss the old stick; you don't need it anymore.

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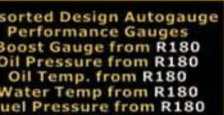
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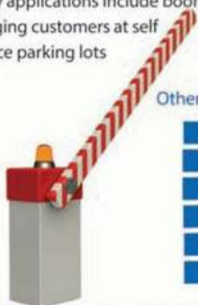
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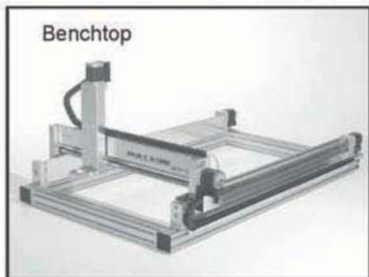


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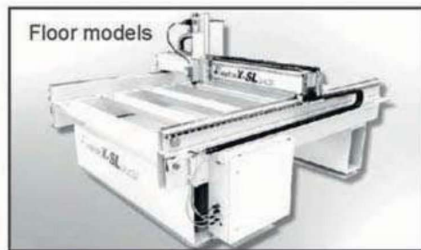
Benchtop

HEIZ Models:
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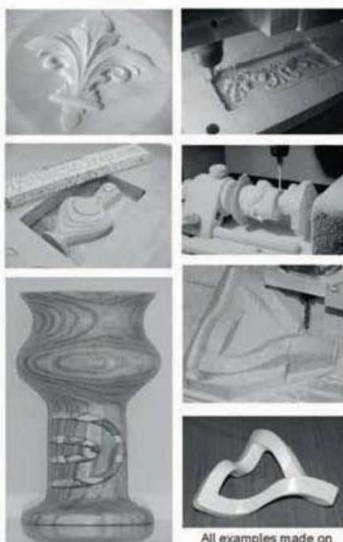
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WINNING TIP

A SHARPER EDGE

When cutting veneered board with a table saw, the underside can end up looking very ragged as a result of the downward-travelling blade tearing or chipping the brittle veneer. This can be avoided with a simple strategy. First, lock the table saw fence at the desired width, then lower the saw blade until only about 3 mm or so projects above the table (the actual depth is unimportant as long as it's considerably less than the thickness of the board) and run the board through the saw.

This will produce a smooth-edged groove on the underside. Now raise the blade to a height greater than the thickness of the board and repeat the cut without changing the width setting, this time cutting right through the material. Turn the board over and you'll have a smooth underside, with no ragged edges.

A word of caution: to do this, you may have to remove the riving knife (if there is one) and possibly the blade guard, leaving the blade exposed. Be very careful, and take it slowly.

CHRIS GRAHAM
RANDBURG

Lookin' good

If you have a bronze artefact such as a statuette or bell that is showing signs of corrosion – specifically, a white, powdery substance – just remove it with a wire brush, then apply a thin layer of olive oil, which will keep it corrosion-free for months and enhance the object's appearance.

CHRIS MOERDYK
SIMON'S TOWN

Revive that old drill

I bought a cheap cordless drill only to discover after a few years that its battery pack was no longer available (and even if it was, it would probably cost more than the original drill). Instead of throwing it away, I converted the drill to spend the rest of its working life in my travel toolbox for use on holidays in the bundu.

Here's what to do: first, make sure the drill uses 12 volts. Next, open it up and connect fairly thick leads to the battery connectors (be sure to get them the right way round; use red for the positive lead), making a small hole in the drill housing to admit them. Attach battery clamps to the other ends, and you're ready to go.

STEFAN SCHOEMAN
TYGER VALLEY

Affordable brush-cleaner

As someone who uses polyester resin and glass fibre mat regularly in my designs, I have found that acetone is the most expensive way of cleaning brushes and rollers before they harden. Acetone can be used only twice before the brushes are no longer cleaned properly, after which they go hard.

SEND US YOUR HINT – AND WIN

Send us your best home, garage, workshop and general DIY hints – and win! This month's best tip wins a Makita JV0600K Jig Saw worth R1 499. This powerful 650-watt tool is engineered to achieve accurate cuts in a variety of materials (90 mm in wood and 10 mm in steel), and features variable speed control (500 to 3 100 strokes per minute) plus three orbital settings for optimum cutting action in wood. For more information, visit www.makita.co.za or contact Rutherford Johannesburg on 011-878 2600, Durban on 031-717 6400 or Cape Town on 021-932 0568.

Send your tips to: PM Do It Your Way, Box 180, Howard Place 7450, or e-mail: popularmechanics@ramsaymedia.co.za. Please include your name, address and contact number. Regrettably, only South African residents are eligible for the prize. Prizes not claimed within 60 days will be forfeited.



You may also use the following as a post-cleaning boost if old and dirty acetone has been used, or to clean short-

hair rollers: dip and work the brush well in a small pool of Handy Andy or good-quality dishwashing liquid. Wash the brush under a tap; repeat if the brush feels sticky. Make sure the brush is completely dry before using it on another batch of resin, as any water in resin halts the chemical hardening process. Warning: This works only if the polyester resin is not in the final stage of setting.

HUGH ROBINSON
DURBAN PM

Biltong-making PC?

Do you have an obsolete desk top computer somewhere, gathering dust? I had an old 486 machine that was just incapable of working with today's software so I gutted it and made it into a biltong maker. I used a light fitting, a 100 watt light bulb, a spare wall extractor fan, some wire, electrical cable and some fly netting that I installed into the box carcass. I can load 2,5 – 3 kg of meat into the machine and in two to three days, I have biltong. You don't have to use all the parts that I used, you can make do with either the light fitting or the extractor fan. It just means that it will take slightly longer to make the biltong. Alternatively you can make use of the existing computer fan. Attached some photos of my biltong maker.

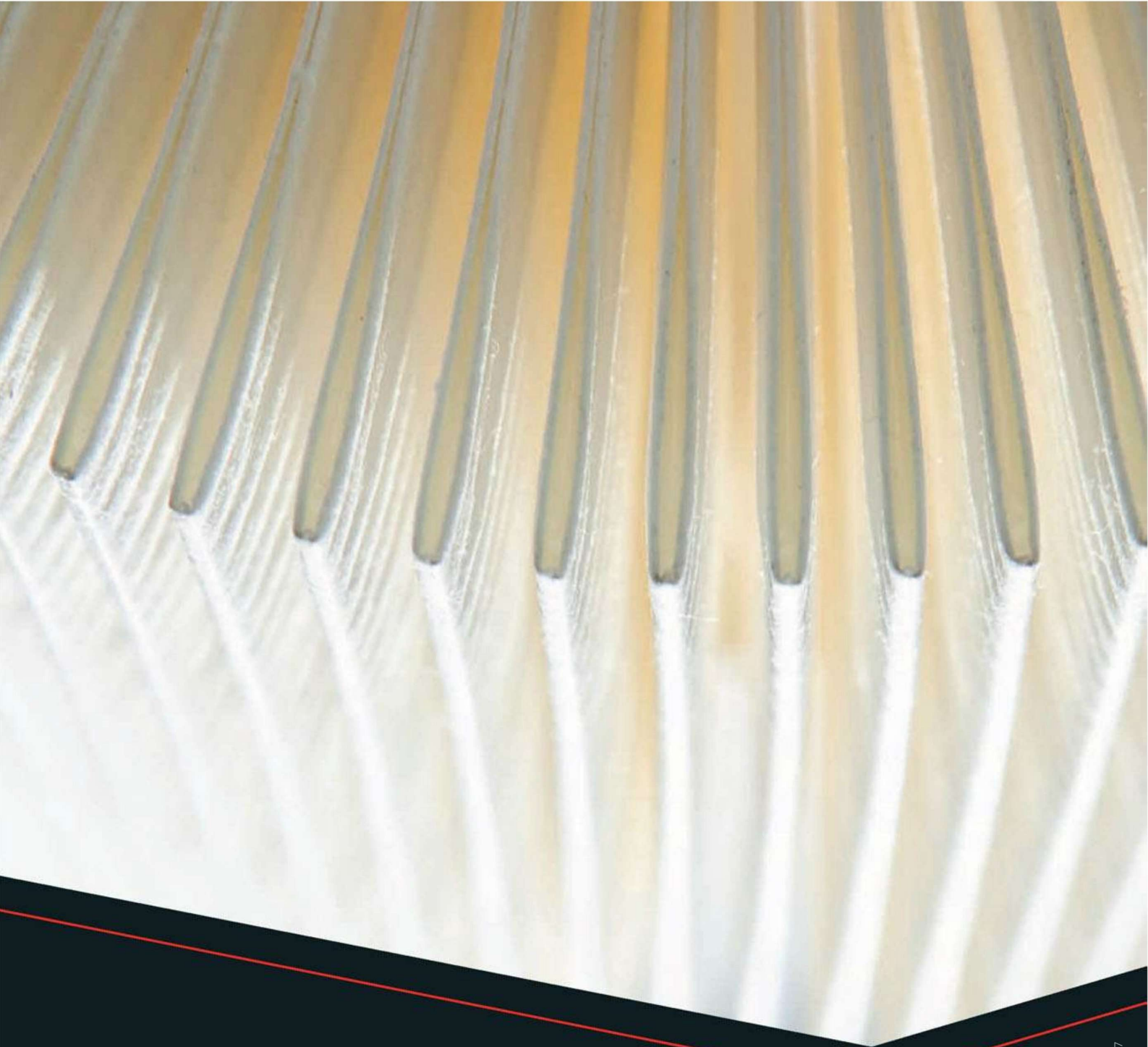
BRENDAN CREAVEN
VIA E-MAIL



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